The Chemical Age

VOL LXV 15 SEPTEMBER 1951 No 1679

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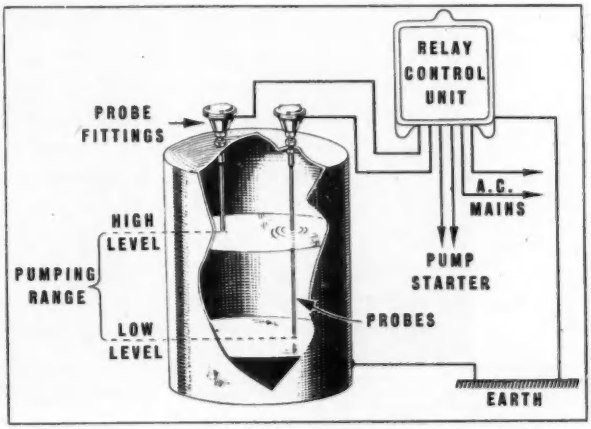

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The
Chemical Age

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Arsenicals and Lung Cancer

DURING the past few years medical experts in this country and abroad have been studying the alarming increase in the incidence of pulmonary carcinoma and many theories have been put forward to explain it. While before 1914 the proportion of deaths due to lung cancer was very small it has now increased phenomenally. In the quarter of a century between 1922 and 1947 the annual number of deaths recorded in the United Kingdom increased from 612 to 9,287, or roughly fifteenfold. In 1949 the figure had risen to 11,272. Out of this number only 1,945 were females. This increase is still continuing and has been noted in Switzerland, Denmark, Canada, and United States, Australia, Turkey, Japan, etc.

Two main causes have from time to time been suggested, viz.: (1) a general atmospheric pollution from the exhaust fumes of cars, from the surface dust from tarred roads, and from gas works, industrial plants and coal fires; and (2) the smoking of tobacco. Some characteristics of the former have certainly become more prevalent during the past 50 years and are still increasing. However, there seems to be no experimental or clinical evidence of the carcinogenicity of dust from tarred roads or fumes from petrol engines. One striking fact, moreover, has led research workers to the conclusion that smoking seems to be the most likely cause, and this is that the disease has a marked preference for males. A careful study both in Britain and the United States shows that approximately five times as many men as women die from cancer of the lung or bronchus, and this proportion roughly corresponds to the difference in the smoking habits between men and women. It is certainly true that the growth in the death rate from cancer of the lung has followed the great increase in the consumption of tobacco. Furthermore, cancer of the lung is comparatively rare in those industries where the men are not allowed to smoke.

In 1950, Wynder and Graham *J. Amer. Ass.*, 1950, 143, 329) reported that after personally interviewng 634 patients in whom cancer of the bronchus had been diagnosed, they had come to the conclusion that the 'excessive and prolonged use of tobacco, especially cigarettes, seems to be an important factor in the induction of bronchiogenic carcinoma.' At the

International Cancer Congress held in Paris in July, 1950, other American specialists supported the view that the incidence of lung cancer was significantly higher in heavy smokers than in non-smokers. In the same year Dr. Niels Dungal, professor of Pathology at the University of Iceland, reported that lung cancer was a rare disease in Iceland, although bronchitis was more common than in most other civilised countries. Tarred roads and petrol fumes, he said, were not likely to be more carcinogenic for men than for women. He suggested that the rarity of the disease might be explained by the fact that it seemed to take 20-25 years for the disease to develop and that cigarette smoking in Iceland had increased at a much slower rate than in America, Britain, etc. In the 30 September 1950 issue of the *British Medical Journal*, Dr. Richard Doll and Professor A. Bradford Hill issued a report in which they concluded that above the age of 45 the risk of developing cancer of the lung increases in simple proportion with the amount smoked and that it may be approximately 50 times as great among those who smoke 25 or more cigarettes a day as among non-smokers. They suggested that the carcinogen in tobacco smoke may be introduced into the tobacco during its cultivation or preparation.

This latter suggestion has since been confirmed by both American and British workers and the only known carcinogenic substance which has been found in tobacco smoke is arsenic. As arsenical sprays have been used for the protection of growing tobacco since the end of the last century it is thought that this is a probable source. Analyses have shown that the tobacco in a cigarette contains between 24-106 μgm./gm. of arsenic, and so the use of lead arsenate, calcium arsenate, Paris green, etc., is looked upon with grave suspicion. So far, however, nothing has been done about it.

Speaking at the recent diamond jubilee meeting of the American Chemical Society, Dr. Eric Boyland, Professor of Biochemistry at the Chester Beatty Research Institute of the Royal Cancer Hospital, urged greater emphasis on cancer prevention through the control of 'hundreds' of known cancer-causing agents. 'The detection of carcinogenic agents is not always easy,' he said. 'Arsenic is carcinogenic for man, and there is at present no laboratory test which will reveal its activity. This is probably important, as it has been suggested that arsenic is present in cigarettes, and may be, in part, responsible for some cancer of the lung'. In a letter to the editor of *Lancet* on 11 August this year, J. H. Oliver points out 'the unusual freedom that seems to be enjoyed by those who choose to use these arsenicated lead sprays on tobacco plants'. 'It seems to me', he said, 'that considered medical opinion might exert some influence to suggest a reasonable balance between the needs of agriculture and the health of man'.

Cancer of the bronchus or lungs is a dreadful disease and unless it is discovered in the very early stages the sufferer has little hope of recovery. The evidence is not yet conclusive but independent research in a number of countries places arsenical sprays under considerable suspicion as far as tobacco is concerned. No one likes the Government interfering too much, but every thinking man must realise that purity standards are necessary safeguards and that they play an important rôle in modern life. As it is unlikely that either the American or British Governments will act until the full truth is known, and as this may take several years, would it not be wise if insecticide manufacturers advised the tobacco growers not to use arsenicals? There are other insecticides which can be used to control budworm, flea beetle, hornworm, the cigarette beetle, etc., and the agricultural chemist could easily advise as to which is best. The chemical industry has contributed immensely towards the relief of pain, the curing of illness and the prolongation of life and it would certainly not wish to be blamed for causing such a dreadful disease. It can render another great service to mankind by giving world Governments a lead in the fight against the increase in cancer of the lung. Although the issue may still be in doubt, we feel that the firm which takes the initiative and advises tobacco growers against the use of arsenical sprays will deserve the thanks of the entire smoking world.

Notes & Comments

Synthesising Cortisone

THE total synthesis of cortisone is of chiefly academic interest. Its main practical value is the understanding it brings of reactions for introducing substituents into and the construction of steroid rings. The commercial production of the drug for clinical use is another story altogether, for here it is the availability of the raw material which matters, not its simplicity, since the more stages in the synthesis that nature can be persuaded to complete, the easier it is for the chemists. Now that better synthetic procedures for the steroid nucleus are known, efforts are directed at finding a substitute for the ox-bile that furnishes desoxycholic acid—previously the only known progenitor of cortisone, due to the fact that it had a substituent at the 11 position which made the introduction of an oxygen atom easier. Now, other materials have been found that contain similar compounds to the bile acids. A plant previously believed to be extinct, called *Strophanthus sarmentosus*, whose seeds yield sarmentogenin—an aglycone with an 11-hydroxyl group—has been found in Africa by the Swiss and also by the Medical Research Council, but these are too rare to be of great use. A 12-oxygenated steroid—hecogenin—has been found by the Medical Research Council to be present in sisal waste up to 0.1 per cent, and it has been found possible to convert this into a 12-hydroxy, 11-keto derivative that would constitute the first step in any cortisone synthesis. As sisal waste occurs in East Africa in quantities as high as 100,000 tons per crop, this might constitute a useful source if the yields are satisfactory.

More Promising Discovery

HOWEVER, the most promising discovery in the search for raw materials has been the recent successful introduction into a steroid nucleus by both Harvard University and Merck's laboratories of an oxygen in the 11 position when no substituent existed on the C ring before. This 'climbing up the molecule'—done by entering ring B first and then restoring that ring to its proper form after ring C has been substituted—means that the relatively abundant steroids—cholesterol, ergosterol, diosgenin (from the yam) and stigmasterol may be used as starting points for cortisone synthesis. The Syntex Company of Mexico have recently done work which simplifies this route, and in the future it may be that plant steroids will provide much of the raw material for cortisone. It is, however, a far cry from laboratory ingenuity to commercial processing, and although it is likely that the present dependence on the restricted supply of bile acids will be removed, it is bound to be a long time before

On Other Pages

The annual subscription to THE CHEMICAL AGE is 35s. Single copies, 9d.; post paid, 1s.; SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3954/5). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham (Midland 0784-5). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers, Limited.

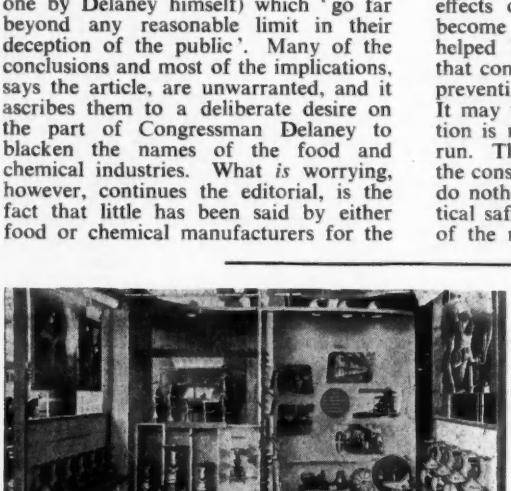
cortisone becomes plentiful and cheap, if, in fact, it ever does become cheap. This does not modify the fact that the recent advances in steroid chemistry as a whole are of the first importance.

Chemical Taboo

IT seems that in America at the moment they are suffering from a rash of anti-chemical feeling similar to the one that occurred in this country two months ago (see CHEMICAL AGE, 14 July 1951, page 37). A certain congressional committee headed by Congressman Delaney, investigating the same subject as was debated by the House of Lords—chemicals in foods—has been making the American chemical industry very angry by using its privileged mouthpiece for making what *Chemical Engineering* call 'innuendos and demagogic attacks' on both food and chemical manufacturers. *Chemical Engineering*, however, in a vehement editorial, asserts that this committee has by its proceedings inspired a number of articles in the popular press (including one by Delaney himself) which 'go far beyond any reasonable limit in their deception of the public'. Many of the conclusions and most of the implications, says the article, are unwarranted, and it ascribes them to a deliberate desire on the part of Congressman Delaney to blacken the names of the food and chemical industries. What *is* worrying, however, continues the editorial, is the fact that little has been said by either food or chemical manufacturers for the committee's records to show the many precautions regularly being taken to ensure that chemical residues do not in fact create an actual hazard to the public.

Inevitable Reaction

COMFORT is drawn by *Chemical Engineering* from the fact that the chief antagonists in this matter are having to base their arguments on exposed scandals that took place some time ago, but even so it urges with some heat that American chemical industry should put forward some of the facts about practised safeguards and protect the public against its own hysteria. It would seem from this that our friends in the American chemical industry are as liable to misrepresentation, when it comes to informing the layman, as we are in this country. There is undoubtedly wide public reaction in progress at the moment against the eagerness with which chemicals have been used as fertilisers, insecticides, bleaching agents, etc.—especially in edible products when any ill effects on the human system may not become apparent for years. This is not helped by occasional factual evidence that comes to light such as that of DDT preventing cheese formation in milk. It may well be, however, that this reaction is not such a bad thing in the long run. The only controller of quality is the consumer, and if his occasional panics do nothing else, they act as a very practical safeguard against laxity on the part of the manufacturers.



The A.P.V. Company, Ltd., exhibited for the first time a range of APV-Cooper stainless steel gate valves at the recent Engineering, Marine and Welding Exhibition. These are manufactured under agreement with the Cooper Alloy Foundry Company of New Jersey

Leather Chemists Meet in London

Abstracts of Papers Read to the International Union

DELEGATES from many parts of the world including Australia, Belgium, France, Italy, South Africa, Spain, Sweden, Switzerland, the U.K. and the U.S.A. attended the conference of the International Union of Leather Chemists' Societies held in London this week.

Proceedings began on Sunday (9 September) with a meeting of the executive in the afternoon, and in the evening delegates and visitors were welcomed by the president, J. R. Blockey, M.Sc., F.R.I.C., at a reception at the Mayfair Hotel.

On Monday morning there was a reception at Skinners Hall, Dowgate Hill, E.C.4, by invitation of the Worshipful Company of Leathersellers and by courtesy of the Worshipful Company of Skinners, followed by the official opening of the conference.

Many interesting papers were read and the following abstracts show some of the wide range of subjects covered by the speakers from different countries.

Speaking on the "Influence of Fine Structure of Collagen Fibres," H. Phillips (U.K.), said that in the textile and fibre-making industries a fibre science had developed based on the elaboration of the conception that fibres were composed of long thin molecules arranged side by side parallel to the length of the fibre. This elaboration, derived from the 'fringe' theory of gelatin structure of Katz and Gerngross, emphasised that the physical and chemical properties of fibres were partly dependent on the proportions of regions in the fibre in which the long thin molecules were regularly and closely aligned (crystalline regions) and those in which the molecules were in a greater or lesser degree of disorder (non-crystalline regions).

Contrasting Fibres

This conception had not been widely applied in leather chemistry, partly because the individual hide and leather fibres were microscopically more complex than textile fibres and their properties were modified seriously because they formed part of a biological structure.

A survey of some of the evidence showed that the newer conceptions of fibre science helped to explain the water and water vapour absorption of collagen fibres, their response to liming and their combination with and absorption of tannins.

'Use of sodium hexametaphosphate in chrome tannin,' was surveyed by J. Jofre (Spain), who showed that sodium metaphosphate known and used with success in vegetable tannage, could also be used in chrome tannage, giving certain properties to the leather not obtainable by the normal process of tanning. An idea was given of the possible application of the hexametaphosphate, and the best conditions for its use.

Effect of *p*H

Many trials had been made on sheep and goat skins using it as a pre-tanning material or as a masking salt, taking advantage of the property of the sodium hexametaphosphate of forming complexes with chrome salts. Tests had been made, pre-tanning with sodium hexametaphosphate and sulphuric acid at different *p*H values which allowed the use of very basic chrome liquors without giving coarse grain. It was unnecessary to adjust the final basicity and leather of fine grain and good substance was produced.

When pre-tanning was carried out at a *p*H over 5, and with increasing quantities of hexametaphosphate, less quantities were fixed and the hexametaphosphate left in the bath reacted with the chrome sulphate forming compounds of reduced tanning power, finally giving hard and cracky leather.

Taking advantage of the property of sodium phosphate forming complexes with chrome salts, tanning was done with chrome liquor of 45 Schorlemmer basicity, to which increasing quantities of sodium hexametaphosphate were added. Fine grain resulted, but with quantities over 4 per cent the leathers obtained were harder and thinner.

Pelt pre-tanned at *p*H 7 with sodium hexametaphosphate for half-an-hour and then tanned with a chrome liquor (45 Schorlemmer) gave the same result, but with a fuller leather. This was attributed to further hydration of the pelt owing to the swelling produced at the particular *p*H.

Less than 4 per cent of the hexametaphosphate should be used.

If chrome-metaphosphate complex was precipitated it would form a colloidal dispersion during drumming and be absorbed by the pelt. The use of hexametaphosphate also assisted in even distribution of the natural grease.

Carboxyl Ions

A Swedish delegate, K. H. Gustavson, gave two addresses. In the first he dealt with the 'Function of the Carboxyl Group of Collagen for Fixation of Cationic Chromium Complexes.'

The fixation of cationic chromium complexes of basic chlorides and sulphates of chromium by cation-exchange resins containing carboxyl as the unifunctional group had been investigated to ascertain the function of the carboxyl group of collagen in its fixation of electropositive chromium complexes. The exchanger was mainly used in the form of the sodium salt. The absence of other binding links in the resin, such as amino, hydroxy and peptide groups present in collagen, simplified the theoretical deductions and made this system particularly interesting and useful for the study of the participation of ionised carboxyl groups of the protein in the chrome tanning process.

Using the resin in the hydrogen cycle, no chromium or only insignificant amounts were taken up by the resin in the *p*H-range 2-4, as shown by solutions of chromium chlorides and sulphates. Hence, the ionic reaction was completely hindered, and hydrogen bonding of chromium complexes did not take place. This corroborated earlier observations on the non-reactivity of acid-saturated collagen (*p*H 1) towards cationic chromium in dilute solutions, adjusted to *p*H 1, which for their combination with collagen evidently required COO-ions of the protein.

For the main experiments, the sodium salt of the carboxyl exchanger, brought to equilibrium with Na ions at final *p*H of 6-7, was used. The Na salt possessed exceedingly strong affinity for cationic chromium complexes, with Cr_2O_3 contents of values of 20-30 per cent on the dry basis of the substrate. The neutral salt effect, that is, the decrease in chrome fixation caused by the addition of neutral chlorides (NaCl) and neutral sulphates (Na_2SO_4) to solutions of basic chromic sulphates, and the increase of the chrome uptake by collagen from solutions of basic chromic chlorides in the presence of neutral chlorides showed the same general trend with these chromium salts reacting with the organolite as with collagen.

A number of other factors and aspects of importance for the theory of chrome tanning had been investigated by this special technique; for example, the effect of chromium concentration and basicity of the salt, masking, and time upon the reaction. The results were considered to be further proofs of the main function of the carboxyl ions of hide protein for the binding of cationic chromium complexes.

In his second paper K. H. Gustavson spoke on the 'Acid Binding Capacity of Vegetable Tanned Collagen with Special Reference to Polymetaphosphate Acid.'

H. Kilchler (Switzerland) chose for his subject 'Paper Chromatography and Tannins'. The Rutter disc technique, he said, had been applied to the paper chromatographic examination of a range of tanning materials including some synthetic tannins. The dried papers were then examined under ultra-violet light. A new classification of vegetable tannins was proposed:—Group 1 (giving mostly green fluorescence), quebracho, mimosa, tizera; Group 2 (mostly violet fluorescence), chestnut, valonea, sumac, myrabolam Chinese and Aleppo galls. Spruce was unclassified. Possibilities of this method were in the identification of synthetic tannins in vegetable tannins, the detection of sulphite cellulose extracts, also the determination and identification of sugars in tanning extracts.

Dyeing Problems

Dyeing of leather, particularly in conjunction with the relationship between the chemical constitution of dyestuffs, their affinity for various leathers and their behaviour in dyeing was discussed by E. Fauré (France).

Other papers included 'Enzyme Unhairing' by G. Leger (Belgium); 'The Complexity of Tanning Extract Composition', T. White, K. S. Kirby and E. Knowles (U.K.); 'Italian Tara Pods (*Caesalpinia Tinctoria*),' G. A. Bravo (Italy); 'Neutral Salt Effect in Chrome Tanning', S. G. Shuttleworth (South Africa) read by Dr. J. Bowes; and 'Lubricating Properties of Mineral Oils as Replacements for Fatty Oils in Fatliquoring', R. M. Koppenhoefer (U.S.A.), read by E. R. Blane.

Determination of Rubber Hydrocarbon

Refractive Index Sole Criterion

A SIMPLE, rapid method for the quantitative determination of rubber hydrocarbon in crude natural rubber has recently been developed by Rachel J. Fanning and Norman Bekkedahl, of the U.S. National Bureau of Standards. As the new method requires only the measurement of the refractive index of a solution containing a known weight of rubber in a known weight of solvent, a single operator can make a large number of separate determinations in a short time. The new U.S. National Bureau of Standards procedure is thus expected to find application in the rubber industry for the evaluation of crude rubber, especially where the lower grades are used.

In addition to rubber hydrocarbon, crude natural rubber contains moisture, resins, proteins, ash and other minor constituents. Although most of the better grades of rubber prepared on plantations contain 93 to 96 per cent rubber hydrocarbon, the lower grades of plantation rubber as well as many types of 'wild' rubber may contain much lower percentages—in some cases as little as 70 per cent or even less. Because of this great variation in the non-rubber constituents, which can largely be considered as inert material, the hydrocarbon content of natural rubber must be known in order to evaluate it for processing and use.

None Satisfactory

While several methods have been available, none of them has proved entirely satisfactory. For example, cumulative errors decrease the accuracy of the method of 'differences,' in which the non-rubber constituents are first determined quantitatively and their total percentage then subtracted from 100. The only two direct procedures currently in use, the chromic acid oxidation method and the rubber bromide method, involve chemical reactions and require empirical correction terms in the calculation of the results from the data. All three of these methods require a large amount of chemical apparatus and extensive manipulation. The new refractive index method, on the other hand, employs no special apparatus other than a refractometer. It makes use only of physical processes and thus involves only measured physical constants and no correction terms.

In the new method, a small sample of the crude rubber is first cut into small pieces and weighed. It is next treated with acetone to remove resinous material. After drying in a vacuum oven for about an hour at 100°C., it is again weighed and dissolved in 1-bromonaphthalene. The resulting solution is made complete and uniform by heating with intermittent stirring for two hours at 140°C. After cooling, the solution is weighed, and its refractive index is measured. From the observed data and from the known densities and refractive indices of the pure solvent and the rubber hydrocarbon, the percentage of the rubber hydrocarbon in the sample is computed.

Two Assumptions

This procedure is based on two assumptions. The first is that all material remaining in the acetone-extracted rubber, with the exception of the rubber hydrocarbon, is insoluble in the bromonaphthalene and consequently has no influence on the refractive index of the solution. The second assumption is that the refractive index of a solution of rubber hydrocarbon in a solvent is a linear function of the volume percentage of the rubber hydrocarbon in solution. Both assumptions appear to have been justified by the results of a large number of measurements on various samples of natural rubber, including plantation rubber, purified rubber, and a variety of wild rubbers.

Assuming a straight line would be obtained by plotting refractive index of the solution against the volume percentage of rubber hydrocarbon present in the solution, the ratio of any two differences along one axis can be set equal to the ratio of the corresponding differences along the other axis. Specifically, the ratio of the volume of rubber hydrocarbon to the volume of solvent in the solution can be equated to

$$\frac{n_S - n_M}{n_M - 1.5190}$$

where n_S is the refractive index of the solvent, n_M is the observed refractive index of

the rubber-bromonaphthalene solution, and 1.5190 is the refractive index of natural rubber hydrocarbon as recently determined at the U.S. National Bureau of Standards. The weight percentage of rubber hydrocarbon in the original rubber sample is then obtained from the equation:

$$\% \text{ rubber hydrocarbon} = \left\{\frac{M-E}{D}\right\}\frac{{}^{n}S - {}^{n}M}{{}^{n}M - 1.5190}\left\{\frac{0.9060}{R}\right\}100$$

where M is the total weight of extracted rubber and solvent, E is the weight of extracted rubber in the mixture, D is the density of the solvent, R is the weight of the sample of crude rubber before extraction with acetone, and 0.9060 is the known density of the rubber hydrocarbon in grams per cubic centimetre at 25°C.

In studies of the method at the U.S. National Bureau of Standards, samples were analysed ranging from partially purified rubber having a rubber hydrocarbon content of about 99 per cent to some wild rubbers containing only about 80 per cent rubber hydrocarbon. In general, the precision of the refractive index method has been found to be about the same as that of the rubber bromide method and somewhat higher than the chromic acid oxidation method. However, an advantage of the chromic acid method over the other two is that it can be applied to either unvulcanised or vulcanised rubber and also to mixtures of natural and synthetic rubbers. This is not true of either the refractive index or the rubber bromide method, which are applicable only to unvulcanised natural rubber.

Beilby Memorial Awards

Administrators Seek Suggestions

FROM the interest derived from the invested capital of the Sir George Beilby Memorial Fund, at intervals to be determined by the administrators representing the Royal Institute of Chemistry, the Society of Chemical Industry and the Institute of Metals, awards are made to British investigators in science to mark appreciation of records of distinguished work. Preference is given to investigations relating to the special interests of Sir George Beilby, including problems connected with fuel economy, chemical engineering and metallurgy, and awards are made, not on the result of any competition, but in recognition of continuous work of exceptional merit, bearing evidence of distinct advancement in science and practice.

In general awards are not applicable to workers of established repute, but are granted as an encouragement to younger men who have done original independent work of exceptional merit over a period of years.

The Administrators are empowered to make more than one award in a given year if work of sufficient merit by several candidates is brought to their notice. In 1950 two awards, each of 100 guineas, were made to Mr. W. A. Baker and Dr. G. Whittingham.

Consideration wil be given to the making of an award or awards from the Fund early in 1952 and the Administrators will therefore be glad to have their attention drawn to outstanding work of the nature indicated, not later than 31 December, 1951.

All communications on this subject should be addressed to the Convenor of the Administrators, Sir George Beilby Memorial Fund, Royal Institute of Chemistry, 30 Russell Square, London, W.C.1.

Institute of Packaging

EDUCATIONAL courses organised by the Institute of Packaging last November have met with a widespread demand from package-using firms for further facilities for training junior packaging executives. The first two courses held last November by the Institute were fully booked, and it is now announced that the next course, to be held in October, is also booked up by the appiicants who could not be accommodated at the last course in March. A fourth course will be held in March of next year, and applications may now be received.

Three meetings of the Institute are to be held in September. On 6 September at the Waldorf Hotel, London, Mr. George Maycock will read a paper on 'Packaging Development over a Generation.' On 17 September there will be a members' open forum at the Imperial Hotel, Birmingham, for the Midland area, and on 24 September another in the Old Nag's Hotel in Manchester for the Northern area. On 5 October the Southern area of the Institute is holding its first social function since it came into existence in 1950. A buffet dance, it will be held at the May Fair Hotel, London. It is expected to be well attended.

Cleaning of Oil Tanks

An Improved Method

AT a Press exposition held recently a completely new and very much better process for the cleaning of oil tanks was described by the Groom Patents Company of Bromley, Kent.

Until recently the thorough cleaning of oil tanks, e.g., when changing over from dark to white products—has always been a laborious and, in general, expensive and time-consuming process with results which were more often than not unsatisfactory. The most difficult part of the process is the removal of the sticky black substance known as asphaltic residuals or bottom sediment, which is usually composed of oxidised oil, asphaltic bitumen, rust, water, sand, etc. Even when automatic equipment was used to remove the bulk of the oil and residue, hand cleaning was still necessary to scrape out corners and baffled parts that could not be reached by automatic means.

Generally speaking the removal of oxidised oil, mineral or fatty in nature, is a necessary evil. For instance the partly oxidised residue of fatty oil, when mixed with a fresh cargo, will cause an increase of free fatty acids with consequent deterioration in storage and decrease in quality.

Another instance of this type of deposit may be found in or under piston supercharger casings, channels, etc. In this particular case automatic equipment was not at all available and the accepted method was to dismantle the plant and clean the various parts by hand.

Disadvantages Apparent

The disadvantages of the 'hand-cleaning' methods in these instances are too apparent to warrant explanation. Further, although much is gained by the automatic cleaning equipment available, until the development of the Groom system, these too had their drawbacks.

As a rule these methods depend upon driving under great pressure a stream of water, previously heated to as high a temperature as feasible (i.e., over 200°F.) against the surfaces to be cleaned. The principle thus is that the deposits are knocked off by the liquid, sometimes after having been partially dissolved by preliminary steaming of the tank. High pressure pumps and very large heat exchangers are thus required and, because the volume of liquid demanded has to be very large (*i.e.*, in the region of 400 gallons per minute at 200 lbs. p.s.i. pressure), pumps and heat exchangers are costly, apart from being heavy and unwieldy. In addition, specially strong deck lines are required to stand the high forces exerted therein.

As a result these automatic means are not easily transportable, and they are consequently only found as fixed equipment aboard tankers or special barges.

Entirely Different

The principle of the Groom system is entirely different. Compared with other systems, this system uses approximately only 4 gallons of liquid per minute at a temperature of 150°F. and a pressure of 100 p.s.i. or lower. Furthermore, the liquid is automatically recovered, recirculated and can be used for cleaning many different tanks. It therefore saves money on capital expenditure and maintenance and running costs, and the time taken to do the job is correspondingly less.

In the Groom system an aqueous detergent solution is heated and pumped through flexible hose (or a fixed pipe line) to the point of use, where it is discharged from either a manually operated or a special automatic projector against the surface to be cleaned. The projector may be relatively close to the surface and its operating zone is infinitely variable.

The hot detergent solution then acts upon the deposit and removes this by a combination of dissolution; reduction of interfacial tension ('soapy' action) and scouring.

The mixture of oil, deposit and used (but *not* spent) detergent solution flows to the lowest point of the tank and is pumped from there to a meticulously designed separating and heating tank. The latter is situated at a central point, for instance on deck, in cases of permanent fixing, or on a barge or transporting lorry. In its course through this tank the detergent solution separates from oil and deposit, is heated and again pumped to the point of use, thus completing the cycle. Any loss of detergent

solution (theoretically nil) is automatically made up. Coincidentally, cleaned oil is reclaimed and automatically expelled from the tank.

The dimensions of the tank are 5 ft. long, 4 ft. wide and 5 ft. high (excluding the make-up tank which is 2 ft. high). It is divided into two parts, one for separating the return liquid, and one for heating the reclaimed solution.

Make-up Tank

The make-up tank, which is seated on top of the separating and heating tank described above, is used for mixing the correct operating strength of detergent solution and passing it to the separating and heating tank when required. This happens when there is not enough detergent solution returning to the separator tank for any length of time to keep the float situated at the interface of oil and detergent solution in the separator tank in the closed position. The float will then drop, opening the valve from the make-up tank and admitting fresh detergent.

The detergent solution delivery pump may be any pump available capable of passing 4-16 gallons per minute of detergent solution at approximately 150°F. and giving a pressure at the point of discharge of 80-100 p.s.i. The returns suction pump must be capable of returning to the separating tank from 4 to 30 gallons per minute (depending on the number of tanks being cleaned at one time) of contaminated detergent solution from the lowest part of the tank being cleaned. A piston pump is not recommended because of solid particles in the return liquid; a pump on the ejector principle is best.

The detergent solution is a hot alkaline degreasant containing a synthetic wetting agent, in a concentration of 7½-10 per cent. Recommended is Houseman's Degreasant 'T' (H.D. 'T').

To operate the equipment requires the attention of only one man, the valves and gauges being zoned to that end. The discharge from the projector or projectors is predetermined by the specially designed nozzles and constant pumping rate, so no attention to the delivery pump is called for after starting up. The only requirement is to vary the speed of the returns by adjusting a valve in accordance with the reading of the interfacial level indicator from the separator tank. This ensures the return of a like quantity of detergent solution to that which is being pumped out plus oil, which latter overflows from a slot. The response of the returns valve to the interfacial indicator may be induced by automatic coupling in which case the operation of the separating, heating and scumming tank requires no manual action at all.

To project the detergent solution against the parts to be cleaned, two types of projector are available, *i.e.*, a hand-operated and an automatic one. The hand-operated one consists of two nozzles, one of which is constructed to project a long unbroken jet of solution, the other being of the flattened fishtail type. By design the two nozzles cannot be used simultaneously, the single control lever opening up only one or the other of the nozzles.

The nozzle giving the long stream is used to project the detergent solution against the more remote surfaces to be cleaned; the other giving wider spread stream to run down floors, angle irons and in general to wash forward accumulated 'dirt.' Whichever is in use should have its way fully opened, thus discharging the predetermined four gallons per minute.

Using the hand projector it is necessary for the operator to go into the tank to be cleaned and 'hose down' the deposit. If this is not possible because of the size of the tank, noxious fumes or excessive heat, or if one prefers not to use manual labour, the automatic projector may be used.

By the Groom system using only one manual projector it took 19½ working hours to clean to bare dry metal by a total complement of three men (one tank cleaner, one attendant to separating and heating tank, one change over and assistant tank cleaner attending to wandering suction in side bay and double bottoms). This is equivalent to 58½ man-hours (excluding initial coupling-up time). The sister tank on the port side by hand-cleaning methods took eight men 23 days. This is 1,472 man-hours, and the tank was not so well cleaned as by the Groom system.

Tungsten Discovery in Canada

Scheelite (tungsten ore) is reported to have been found by Mr. J. Adelard Rochelau, a Montreal prospector, at two points situated about 60 miles east of Yellowknife, North West Territories. Further parties of prospectors have left Montreal by aeroplane to join those staking holdings.

Hydrogen Peroxide

Some Lesser Known Production Processes

WHILE hydrogen peroxide in concentrated condition has aroused no small amount of interest recently as a source of power, and has been widely dealt with in connection with its varying industrial uses, there are some odd processes for its production which appear generally to have escaped attention.

Its uses in soap-making, refining oils and fats, disinfecting and antiseptic applications, paper-making, leather and tanning, dyeing and calico printing, for bleaching straw, ivory, and hair and so on, and in the fermentation, preservative, pharmaceutical, and veterinary lines, give but a limited indication of its extensive demands.

Lesser known applications are in the preparation of a number of organic commodities in rare metal recovery processes, and in the manufacture of various proprietary bleaching and decolorising agents. In each of these the diluted solution of from 10 to 100 volumes suffices, whereas in the latest power applications the almost fully concentrated material approaching 100 per cent purity is necessary. Among the proprietary products are 'Sanitas Fluid', 'Hyperol' (a compound of hydrogen peroxide and urea which by hydrolysis with water yields a 35 per cent solution of the peroxide), and 'Perhydrol' containing 30 per cent H_2O_2 by weight, as produced by E. Merck, Darmstadt.

Storage Arrangements

Reference should also be made to the somewhat elaborate arrangements made for suitable storage of the commodity, where consumers are not in a position to make their own product, and these have been described in various issues of *Pharm. Ztd., Chem. Ztd.*, and *Zeit. f. anal. Chem.*

Anaysis comprises the examination for minute quantities of free acid, magnesia, alumina, and phosphoric acid, while for quantitative estimation permanganate titration is usually sufficient. The reason for such precautions is that explosions have been known to occur during storage owing to decomposition, which is assisted by the presence of alkali in the glass bottles. Storage should therefore be made in bottles prepared for the purpose, in a cool place, and out of contact with light and air.

While electrolytic processes have recently received most attention, it is worth noting that no small success has also been attained by adaptations of the earlier production from barium peroxide. Several methods have been worked out for simultaneous production of barium sulphate (blanc fixe) and hydrogen peroxide, either directly or by the intermediate use of phosphoric acid, among which might be mentioned British Patent No. 252,768.

Alternative Advantages

Continuous methods of using the same barium sulphate solely for hydrogen peroxide production, hold alternative advantages. By heating four molecules of barium sulphate with four atoms of carbon in the form of coke in the electric furnace, sulphur dioxide is expelled, and the monoxide BaO produced. By heating this oxide to some 700°C. in a supply of air freed from carbon dioxide (by passing first through sodium hydrate solution) the peroxide is prepared. On treatment with sulphuric acid, hydrogen peroxide is produced with barium sulphate, which is filtered off, dried, and returned to the electric furnace charge.

The costs of this process, which is an adaptation of German Patent No. 111,667, are electric current, coke, and sulphuric acid. By first preparing barium hydrate either directly or electrolytically (German Patent No. 129,324) from the barium sulphate solution, and heating with barium carbide in the presence of a small proportion of hydrocarbons, a type of porous oxide is produced. This is claimed to be eminently suitable for conversion to barium peroxide for ultimate hydrogen peroxide production (German Patent Nos. 125,936, and 142,051). Alternatively the mineral witherite can be reduced by barium carbide by heating out of contact with the air in the direct manner (German Patent No. 135,330).

A process which is apt to arouse some erroneous criticism is that of reducing a mixture of barium carbonate (witherite) and barium nitrate, which in the presence of carbon causes the expulsion of both carbon

monoxide and nitric oxide. The feature to observe is that the barium nitrate is obtained as a waste or by-product from another process, although this is not stated in the specification (German Patent No. 158,950).

Another method of hydrogen peroxide production is by the decomposition of barium percarbonate, which gives H_2O_2 and barium carbonate on treatment with water, the carbonate being reconverted to percarbonate for further use (German Patent Nos. 178,019, 179,771, and 179,826). Besides making hydrogen peroxide from barium peroxide as obtained from any of these processes, using hydrochloric, sulphuric, or phosphoric acids, the substitution of hydrofluoric acid gives a form of sodium fluoride which on combining with aluminium fluoride provides an artificial cryolite for imitation precious stone production. (German Patent No. 132,090.)

H_2SO_4 Concentrator

Highly concentrated solutions of pure hydrogen peroxide are prepared from the treatment of sodium peroxide and sulphuric acid, which, without removal of the dissolved sodium sulphate is distilled directly (German Patent No. 152,173). Up to 90 per cent concentration is obtained using what is known as the sulphuric acid concentrator, and by fractional freezing 100 per cent hydrogen peroxide is obtained.

Although these methods of obtaining the peroxide through the agency of barium are sometimes considered old-fashioned, they are still considerably used to-day. This is largely due to the complications which exist with what is regarded as the much more efficient electrolytic processes, which provide hydrogen peroxide more or less directly, do not necessitate disposal of blanc fixe or other by-product, and permit the work to be carried out within a relatively small floor space. Reference to two BAOR reports on the subject, however, reveals that exceedingly close control is necessary, and that many variations of the electrolysis method exist.

To those already engaged in other electrochemical pursuits, this is no exception, as the large list of patents on electrolytic production of indigo and other derivatives reveals (to make a success of electrolytic white lead production, a junior chemist and electrical engineer have to be in constant attention, making rough tests at individual cells throughout the whole day).

In making hydrogen peroxide from persulphuric acid or persulphates, complications arise due to the reversible nature of the reactions, and to the fact that oxygen can be evolved, thereby reducing the oxidising power of the persulphuric acid. Firms engaged on this work among others are Elektrochemische Werke Muenchen A.G., Consortium für Elektrochemische Industrie, and Elfa Elektrochemische Fabrik. A good deal has been written on various proposals for altering the working procedure to acquire best results.

Where the peroxide is obtained from heating or distilling potassium persulphate, with additions of water and sulphuric acid, and distilling the sucked-off liquid under reduced pressure at some 80°C. the loss of oxygen can be within three per cent, while the potassium bisulphate recovered can be re-oxidised to persulphate electrolytically, thus forming a more or less cyclic process. This was the method empoyed by Elektrochemische Werke Muenchen A.G. until comparatively recently.

The second firm (Consortium für Elektrochemische Industrie), uses sulphuric acid as the raw material, but this requires considerable care in its selection and application. Using cells with or without diaphragms and at high current densities, and the bath taking from 5 to 5.5 volts, small additions of hydrochloric and even hydrofluoric acid provide up to nearly 50 per cent persulphuric acid, at 60 per cent current efficiency.

Acid Hydrolysed

This acid is hydrolysed to give hydrogen peroxide which is distilled off, while the residual solution is returned for further electrolysis following cooling and diluting, thereby again providing the desired cyclic process (German Patent Nos. 237,764, 217,538, and 217,539; British Patents protecting this work Nos. 23,548, 23,158, and 23,660). Unlike the earlier German patents quoted above covering the barium methods, most of the electrolytic ones can be obtained from those appended to *Chemistry and Industry* and *British Abstracts*.

From actual working experience, the high cost of platinum prohibits its use as an electrode, but no small success has been attained with hollow water-cooled tantalum anodes, which are finely plated on the surface with platinum or rhodium. When superposed alternating current was experimentally

applied, output of persulphate was so rapid that it was necessary to re-design the cells to permit a worm conveyor to be connected at the bottom, to draw off the crystals continuously. Despite this, the temperature can be maintained at less than 20°C. by the cooling of the anode.

Whereas formerly one lb. of hydrogen peroxide of 25 per cent strength required an energy expenditure of some 7 kWh, to-day one lb. of material computed water-free requires only some 6 kWh. This great difference is due to many reasons, since with better cell construction some 90 per cent current efficiency is achieved. It was found that only 70 per cent current efficiency could be genuinely obtained where the persulphuric acid process was used, whereas by a more economic preparation of ammonium persulphate first, a 20 per cent improvement accrued.

An adaptation of the process of Muller and Friedberger, which uses an addition of 0.2 per cent potassium dichromate (as in the electrolytic chlorate process) is to knock out the chromium as hydrate from the reduced solution. This is done by making controlled sulphur dioxide and ammonium hydrate additions in minute quantity, followed by other treatment which provides a pure ammonium sulphate solution, free from dichromate. The addition of fresh dichromate is thus simplified when re-cycling the solution through the succeeding electrolysis.

Vacuum Distillation

Vacuum distillation is again resorted to in obtaining hydrogen peroxide from the persulphate. By attaching perforated plates to the electrodes, loss of voltage caused by gas bubbles is largely forestalled. As the gas bubbles are forced to go through the holes of these plates, the current is left more free, as there is not the same interference, and the resulting increased circulation assists in equalising concentration differences, which earlier gave much trouble. By means of specially shaping the cathodes and anodes, overvoltage has also been largely reduced. (*Die Chemische Fabrik*, 7 July, 1937).

In other directions it has been claimed that up to 15 per cent in current consumption can be saved by using high pressures up to 150 atmospheres, which reduces the volume of gas bubbles and likewise the ohm resistance. One of the Siemens-Pestalozza cells is constructed for this purpose, and, among others, it is obtainable commercially for consumers of persulphates and hydrogen peroxide.

Altogether methods of hydrogen peroxide manufacture as obtained from electrolytic products would appear to have fluctuated between persulphuric acid, ammonium persulphate, and potassium persulphate as the intermediate materials for re-cycling.

In each instance the final stage consists of obtaining the hydrogen peroxide by distilling or by refrigeration. For all industrial purposes, the distillation process at low pressure is sufficient, giving as it does up to 90 per cent concentration.

Material Dangerous

This material alone is dangerous and causes wood, wool, and other materials to take fire where these contain traces of impurities. The 100 per cent material can be even more of a hazard as it attacks glass, and requires special freezing conditions for storage. Freezing at approximately 1.7°C. it can therefore be freed from water by fractional freezing, which if applied under the best conditions is actually more economical than the distillation system, although as a rule both are used.

It should be noted that the latent heat of congelation of water is only 145 B.Th.U. per lb. whereas when condensing by heating, the heat of evaporation is almost 1,100 B.Th.U. In some modern chemical processes, crystals of commodities are obtained using refrigeration systems where much time is saved, as the solution (normally to be evaporated) is chilled, and insertable rods on periodical withdrawal of the frozen contents, allow the same tank to be used continuously for a vastly increased volume.

Dilute hydrogen peroxide solidifies above normal freezing temperatures, and so is removed prior to water. A repetition of the process gives the concentrated 100 per cent product. Formerly, a 96 per cent solution was concentrated by cooling with a mixture of ether and carbon dioxide on the large scale to provide the anhydrous material which consists of fine colourless crystals (Staedel's process). Refrigeration plant is made by Linde A.G. Wiesbaden, and Ziemann A.G. Stuttgart-Feuerbach .

Dangers of the concentrated material exploding are not so great when in the crystalline condition, and it is claimed to be transported in this way without difficulty.

Radioactive Wastes

ABILITY to find increasingly effective and economical methods of processing and disposing of its hazardous waste products might well affect the whole future of atomic energy from the experimental phase to the application of its products, declared Mr. J. H. Hayner, of the United States Atomic Energy Commission's engineering department, in his address to the diamond jubilee meeting of the American Chemical Society in New York on 7 September.

At least three methods of removing dangerous radioactivity had been worked out by the AEC, said Mr. Hayner.

The three operations—evaporation, ion exchange (chemical reaction), and co-precipitation—could be used either independently or consecutively.

Glass-wool filters which effectively removed the radioactivity from liquid-wastes and produced a distillate which could be safely discharged into a river, were employed in the first process.

In ion exchange the system used was to run the contaminated liquid over beds of special plastic beads which underwent a chemical reaction with the radioactive chemicals in the liquid, removing and replacing them by harmless chemicals.

The third method involved the introduction of a chemical reaction in the waste liquid which caused the radioactive material to sink to the bottom of a tank from which it could be collected.

Chief danger of radioactive material, according to Mr. Hayner, was its emission of X-rays and fast-moving sub-microscopic particles which penetrated the human flesh and caused injury to the internal organs.

Photographic Exhibition

THE Royal Photographic Society's 96th annual exhibition was opened by the Right Hon. The Lord Brabazon of Tara, on Thursday, 13 September, in the Society's House, 16 Princes Gate, London, S.W.7 It will be open to the public without charge until Sunday, 14 October from 10 a.m. to 8 p.m. daily (Saturdays 10 to 5.30 p.m., Sundays 2.30 to 5.30 p.m.).

This is recognised as the premier photographic exhibition of the world, comprising as it does all types of photography. Over 5,000 entries were received, of which 908 have been accepted. Pictorial photography undoubtedly provides the main interest but there are excellent examples of scientific, nature, stereoscopic and record photography, in monochrome and colour. There are 14 sections of the exhibition and the voluntary services of 51 selectors were required.

In the exhibition the selectors aim at showing work which provides a fair cross section of contemporary photography, as shown by the material which is submitted for consideration. The Society exists for the development of the science and art of photography and this purpose it endeavours to pursue quite objectively.

After the London display the whole of the exhibition will be transferred to Aberdeen, where it will be shown in the City Art Gallery from Saturday, 3 November, to Saturday, 24 November 1951.

Expansion in Canada

FURTHER expansion in the production facilities of Dow Chemical Co. of Canada is under way. The largest addition is to the chlorine cell building which is being increased by 17,000 square feet. This will provide for the increase of chlorine requirements within the Dow plant necessitated by the general expansion programme. It will also make a greater volume of caustic available for the use of general industry.

Another major expansion is a four-story addition to the Styron unit. When completed early next year the expanded facilities will allow for production of new types of Styron (Dow polystyrene plastic) not previously made in Canada, and for its increased production to meet the rising demand in both Canada and from abroad.

Meanwhile, construction of the $1 million ammonia plant begun late last year is progressing rapidly. Building is practically completed and equipment is now being installed. Production is expected to begin early in 1952. Provision has been made to allow for rapid expansion of this unit.

Other construction includes an extension to the present plant to facilitate the transfer into drums of products such as the ethylene glycol produced by the glycol unit for the anti-freeze market and DowPer and DowTri produced by the solvents units for dry cleaning and metal degreasing purposes. A new service water pumping station is also under construction.

Controllability and Plant Design

Part I—Process Variables and Control

by Leo Walter, A.M.I.Mech.E., Consulting Engineer.

A SUBJECT which is of interest to both designers and users of plant equipment in the processing of goods, is 'controllability'. The equipment may be a single apparatus, or it may consist of many machines, but it must have one inherent quality in any branch of industry, to be efficient in operation, and that is 'controllability'. The average designer does not always take this most important design factor into consideration when developing a new piece of machinery or apparatus for the processing of goods. Naturally, he looks first into the question of working conditions in general, materials to be used in design, required maximum output, general plant layout, and the many other factors which influence the design of new plant, and he usually considers controllability last. This is wrong, and leads in the end either to difficult hand control of the piece of equipment, or, if automatic process control is attempted, this oversight on the part of the designer makes the use of elaborate and costly automatic control gear necessary.

Let us elaborate a little and take a few practical examples, in order to stimulate consideration of controllability when designing new plant equipment.

Process Variables and Control.—Each control problem can be regarded as some form of action or reaction, which must be counterbalanced by the control instrument in order to achieve balance within the process.

Must be Counteracted

For example, in a thermal process, a drop of temperature must be counteracted by increased heat input. An increase of steam pressure in a pipeline has to be counteracted by the action of a reducing valve or pressure regulator. Increased condensation in a chemical reaction must be balanced by adding more liquid for dilution. Humidity control keeps the moisture-content of air within a room constant by adding or removing water vapour to the incoming air.

Action and reaction follow each other in order to keep a certain quality or quantity constant, when it is desirable to maintain a condition free from variations during the whole process. On the other hand, some chemical processes require predetermined variation of a certain process quality, for example, rise and fall of temperature following a time-temperature curve. Time-cycle controllers have been developed to meet this demand.

These examples deal with process 'variables,' which is the general expression for controlled media or quantities, such as pressure, temperature, rate of flow, etc. The definition of this term may be as follows: 'Any manifestations of a process or of the processed material which may vary with time, during processing of goods, is a process variable.'

Process Variables

Electrical quantities, velocity, speed and other physical properties can be process variables. Among the variable properties of chemical processes are chemical composition, density, viscosity, electrical conductivity, and many more.

A process may be either a batch process, where a certain quantity of material is involved, or a continuous process, where material flows into the plant equipment and leaves in a continuous stream at the same rate. For example, a cabinet drier dries a given quantity of goods, which are loaded into the compartment and unloaded after the batch has been dried. A conveyor drier, however, performs a continuous process where the ingoing material leaves continuously at the other end, after being dried during its passage, and its controllability may be higher or lower than that of a batch drier.

Process Analysis: It is generally necessary to analyse the process when attempting to apply automatic control, first by examining its mechanical, physical and chemical properties, and afterwards by eliminating all those process variables which are of no importance to the special control problem. A process contains a number of variable properties which can be independently controlled, and also other properties which are dependent on them. For example, pressure and temperature of saturated steam are dependent on each other, and so are viscosity of oil and its temperature. Similarly

temperature and composition of a liquid determine its density and *p*H.

By first eliminating from observation all properties which have no influence on the control problem, the application of automatic control can be analysed in a simpler way. The simplest problem is automatic control of an 'independent' variable, *e.g.*, liquid level. In general for instance, it makes no difference to a level controller if the temperature of the liquid in the vessel varies slightly. Temperature can therefore be eliminated from analysis right from the start.

On the other hand, some process properties may be closely interlocked. For example, in combustion control, the CO_2 content of flue gases, their temperature and chemical composition, such as content of excess air, are all dependent on each other, and controllability of a steam boiler depends on a multitude of factors, partly of design, partly of operation.

Thermal Processing: The great majority of control problems confronting the designer of industrial plant equipment are of a thermostatic nature, *i.e.*, apply to flow of heat during manufacture of goods. It is impossible to deal in detail with the innumerable actual designs of plants for heating or cooling air, gases, liquids or solid substances, but a few examples might put the main points to the ambitious progressive designer who has to tackle designs involving the use of automatic control instruments.

Basic Considerations

The first example has been chosen to explain briefly some basic considerations influencing the design of a heating process. Taking a calorifier first, in the form of the usual closed cylindrical vessel with steam coil, the heater can be designed in various ways. Assuming that the design concerns a hot water supply calorifier with more or less instantaneous draw-off, the design factors to be considered are volume per draw-off, time intervals, and temperature. These determine the size of the vessel, of the heating coil, and of the inlet and outlet.

The problem of generation of a certain volume of hot water can be solved in three ways: by designing either an instantaneous heater (Fig. 1A), or a medium sized vertical storage calorifier (Fig. 1B), or a large cylindrical horizontal storage calorifier, as shown in Fig. 1C. The choice of type may depend

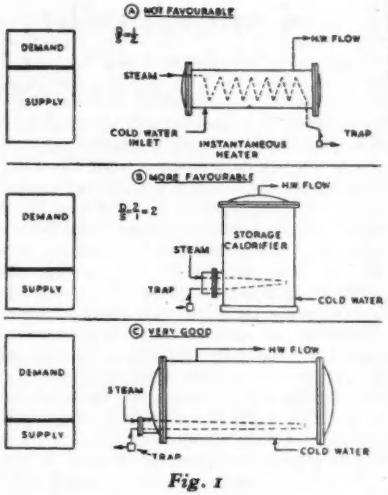


Fig. 1

on various practical considerations, such as space available, first cost and installation cost, and on other considerations, but for our example we will consider controllability first, *i.e.*, the use of a thermostatic regulator for automatic control of steam admission in order to produce hot water *at constant outflow temperature.*

The designer, who is anxious to produce a heater doing this in the most convenient way, will choose the design according to what accuracy of temperature control he wants. This accuracy depends to a great extent on the actual use of the generated and controlled hot water. For a shower bath installation, for example, very close control is required, and the type with the best control has to be designed. For some industrial processes, however, only medium accuracy may be required, as, for example, in filling a process tank with hot water. Here a design can be chosen, which has only medium controllability. Where quick generation of hot water from steam and cold water is required, close temperature control cannot be expected, and an instantaneous water heater might suffice.

Controllability of a calorifier depends, among other factors, on the ratio of 'demand side' heat capacity to 'supply side' heat capacity, and the respective capacities are symbolised in Figs. 1A, B, and C by

rectangular areas on the left of each design. The demand side capacity varies with the stored water volume, and the supply side capacity varies with the steam volume within the heating coil.

A large demand side capacity, *i.e.*, large storage volume compared with small steam coil volume as shown in Fig. 1C gives best controllability, because in case of draw-off of hot water the large amount of stored heat in the stored water smoothes out the lowering of temperature from the inflowing cold water. The dimensions of the steam coil. *i.e.*, supply side heat capacity must, of course, be big enough to heat up during the allowable time interval between two draw-offs. In Fig. 1A, there is very little heat stored in the hot water within the small cylinder, and so it needs a continuous vigorous control action, or constant movement of the steam control valve, to produce anything like uniform hot water temperature. A small demand side capacity (water) and large supply side capacity (steam) are an unfavourable characteristic of the instantaneous calorifier.

Similar considerations apply to hot water tanks with steam or hot water coil, and the shape and volume of the tank and the heating coil should be considered by the designer if thermostatic control is contemplated. This simple example indicates that the design of vessels for heating a liquid either by steam (or hot water) coils, or by direct steam injection, can be conveniently adapted to produce good temperature control by using simple thermostatic controllers, provided that some thought is given to controllability. The progressive designer of industrial vessels using heating coils will therefore be well advised to call in the control expert or instrument engineer, whenever he knows that themostatic control is contemplated for a new design.

Practical instances, where controllability should be considered in the first stage on the drawing board are: acid baths and pickling

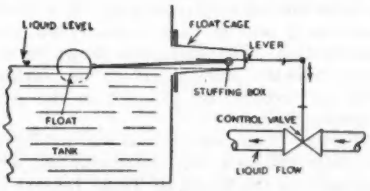


Fig. 2

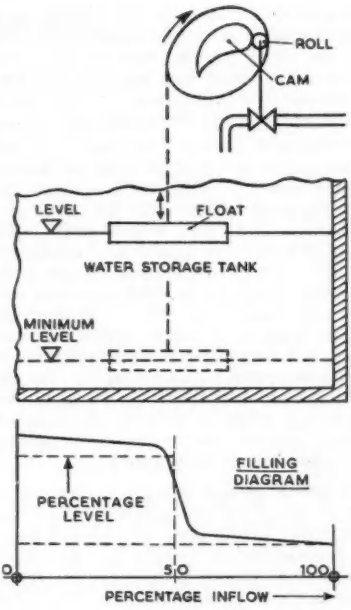


Fig. 3

tanks in the manufacture of steel tubes or sheets; hot pits, puers, and drums in tanneries; dye vats and closed dyeing machines for textile manufacture; boiling pans and tanks in the chemical and food industry, and many more. I will later explain the fundamental considerations regarding controllability of heat flow processes in some detail, because one of the most encountered problems of controllability is of a thermic nature.

Liquid Level: Another example of how the designer can influence controllability is shown in Fig. 2, which illustrates an open-topped liquid storage tank, where the liquid level is to be controlled from the inflow. The well-known ball-float/lever control valve is shown with outer stuffing box or torque tube in a cage. Two main factors influence the accuracy of the liquid level, namely, the design of the ball float valve and lever arm, and design of the tank. Filling time of the tank can be shortened by designing a control valve operated by means of a cam (*see* Fig. 3), whereby instead of a

long throttling action a full opening of the inflow control valve is produced during most of the filling periods, with throttling only commencing near the fully filled position. Alternatively a better control can be achieved by using a sloped, spring balanced displacer.

The controllability of the tank itself, however, can be greatly influenced by choice of dimensions on the part of the designer. Considering two tanks with the same total volume, a high tank with a small bottom area (whether rectangular or circular) will be less controllable than a shallow vessel, because a high liquid level fluctuates much more with change of rate of inflow in a tall vessel, than in a broad vessel, and would need, therefore, a much more responsive and elaborate control. In analogy to the thermostatic problem above, the larger the base area of a vessel in ratio to its height, the easier becomes the level control problem, all other factors being equal.

Furnace Design Problems: Among the many design factors which influence controllability a few more may be mentioned. A problem which sometimes confronts the designer of industrial furnaces is furnace pressure and furnace draught. The writer has published a treatise on automatic control of modern furnaces and may be permitted to quote the words written about future developments of furnace design:—

'Designers of modern furnaces have as their target mechanisation of operations, and wider use of measuring and controlling instruments. Air/gas or air/fuel oil ratio control, combined with furnace draught control should be installed on every new furnace suitable for it. Increased controllability will have to be considered in novel designs, and mechanisation of loading will eliminate over-loading or underloading, which are both detrimental to good control. Gas-fired furnaces without fully automatic control of air and gas volume of supply, pressure, draught and temperature may well become out-dated.'

Great Opportunity

In addition to the above it should be remembered that the design of modern steam boilers and of modern boiler furnaces and stokers offers great opportunity for a designer to consider controllability of combustion during the first design stage. To make a steam boiler design and/or automatic stoker design as 'elastic' to variations of steam demand as possible is one thing, but to make them best suited for 'engineered' control of furnace draught, CO_2 content of flue gases, and rate of steaming at constant desired boiler pressure causes designers of new steam boilers some headaches. The writer has followed the development of steam boilers and of firing equipment during the last 30 years, and has seen many new boiler designs remain more or less in their drawing board stage, simply because prototypes did not come up to expectations. Things threaten to become worse for future designers of boilers, because the use of fully automatic boiler control embracing combustion and feedwater control, etc., will become more widespread in coming years, and steam boilers will simply have to be designed for highest controllability, or they will merely remain designs, and unsuitable ones at that.

(To be continued)

Census of Production Report

THE first section of the final report on the Census of Production for 1948 was published on 7 September, and consisted of the Introductory Notes and the Report on the Blast Furnaces Trade. (H.M.S.O., 2s. 1½d. and 1s. 7½d. post free).

The complete final report will include 156 separate booklets corresponding to the trades covered by the census. The Introductory Notes describe and explain the scope and methods of the census, the bases of the questions asked, and the calculations made in compiling the figure shown in the trade reports.

For the final report corrections and amendments have been made to the figures published in the preliminary reports (summarised in the Board of Trade Journal of 11 August, 1951) as a result of a few late returns and of re-classification of a small number of returns made necessary by later information. The aggregates shown in the final booklets may therefore be slightly different from those included in the preliminary reports.

Further trade reports will be published at short intervals and announcements will be made in the Board of Trade Journal as they become ready for publication.

American Tour Begins

U.K. Scientists Visit to U.S. Institutes

THIRTY-THREE British scientists are among the 300 chemists and chemical engineers from all parts of the free world who on Thursday began a six-week tour of educational, industrial and governmental research centres in thirty-five American cities.

The tours, jointly sponsored by the Economic Co-operation (Marshall Plan) Administration and the Ford Foundation, were staged in conjunction with the International Chemical Conclave in New York and Washington, 3-15 September. The American Chemical Society which will hold its 75th Anniversary Meeting during the Conclave, is in charge of the tour project.

In announcing the visitors' programme, the American Chemical Society said its purpose is to provide foreign chemical leaders of the future with a first-hand view of American industry's research powers and techniques. Tours are limited to younger chemists, most of them under 40 years old, who are employed in 48 countries of the free world.

Great Opportunity

The Society said the ECA-Ford Foundation project is designed to help young scientists who, because of the world dollar shortage, would be unable to visit the United States. Participants from Marshall Plan countries will arrange their own expenses to and from New York, he explained, while those from outside ECA's sphere will be assisted by the Ford Foundation. Expenses of the American tours will be financed by the joint sponsors. Five groups of 60 visitors have been organised so that each scientist will visit plants and research centres devoted to his particular interests.

The British delegates, who were chosen by the Royal Society in consultation with the Association of British Chemical Manufacturers, are:—

Dr. J. R. Arthur, British Coal Utilisation Research Association; Dr. C. H. Bamford, Courtaulds Research Laboratory; Mr. C. F. P. Bevington, Research Department, Imperial Smelting Corporation; Dr. S. Blackburn, Wool Industries Research Association; Dr. E. T. Borrows, Petrocarbon, Ltd.; Dr. H. H. Chambers, Sondes Place Research Institute; Dr. G. A. Collie, The Airscrew Company & Jicwood, Ltd.; Dr. D. S. Davies, Research Department, I.C.I., Ltd., Dyestuffs Division; Dr. J. G. Davoud, Courtaulds, Ltd., No. 1 Laboratory; Mr. D. A. C. De Rycke, Peter Spence & Sons, Ltd.; Miss P. M. Durrant, E. K. Cole, Ltd.; Mr. Joseph Elks, Glaxo Laboratories, Ltd.; Mr. R. I. Felix, Allen & Hanburys, Ltd.; Dr. O. A. J. Gurton, Imperial Chemical Industries, Ltd., Nobel Division; Dr. N. G. Hind, The Evans Biological Institute.

Dr. P. Johnson, Department of Colloid Science; Dr. W. A. Johnson, The British Drug Houses, Ltd.; Dr. L. J. Jolley, Fuel Research Station; Dr. J. K. N. Jones, Reader in Chemistry, University of Bristol, now on leave of absence at The Institute of Paper Chemistry, Wisconsin; Dr. C. Kemball, Trinity College, Cambridge; Dr. J. C. Kendrew, Peterhouse, Cambridge; Mr. D. M. G. Lloyd, Chemistry Department, The University, St. Andrews; Dr. A. W. Marsden, Commonwealth Bureau of Dairy Science; Mr. R. G. Mason, Boake, Roberts & Co., Ltd.; Dr. H. T. Openshaw, Chemistry Department, The University, St. Andrews; Dr. D. S. P. Rorbuck Monsanto Chemicals, Ltd.; Mr. E. Shamash, Leda Chemicals, Ltd.; Dr. E. S. Stern, J. F. Macfarlane & Co.; Dr. J. P. Stern, Sir John Cass College; Dr. J. H. Turnbull, Chemistry Department, Birmingham University; Dr. J. W. Wilkinson, Westminster Medical School; Dr. C. L. Wilson, Microchemistry Laboratory, Queen's University, Belfast; Dr. D. W. Wilson, Sir John Cass College.

Joint Autumn Meeting

The joint meeting of the Refractory Materials and Building Materials Section of The British Ceramic Society will take place in London, 7-9 November. The technical sessions will be held on the afternoon of Wednesday, 7 November, and the morning of Friday, 9 November, at the Royal Sanitary Institute, 90 Buckingham Palace Road, London, S.W.1. The whole of Thursday has been reserved for a visit to the works of Moler Products, Ltd., Colchester.

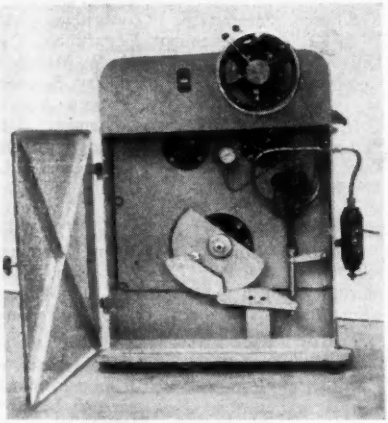
New Servomotor

More Powerful Design

MOST air-operated servomotors used in automatic or remotely-operated control systems are of the cylinder and piston type. The power such designs can exert is limited by the diameter of the cylinder, the length of stroke and compression of the air.

Messrs. James Gordon & Co. Ltd., have now developed a new type of servomotor to operate in conjunction with their Hagan relays and automatic regulators, which is said to have all the advantages of the simple servomotors mentioned above, but which in addition is far more powerful and which therefore can be used in cases where the standard piston type would fail.

A heavy 10 in. operating lever has to be connected by a rod to the damper, gate, or valve it has to operate. It can be fitted at any suitable angle, and when the servomotor comes into operation, will travel at a speed of 6° per second, therefore making its total travel of 60° in 10 seconds.



Gordon-Hagan servomotor

The lever is driven through high efficiency spur gearing by a specially designed piston type air motor. At the high speed end of the gear train a double clutch assembly is fitted which enables the machine to be taken off automatic or remote control and to be operated by hand. The wheel provided for this purpose is clearly visible in the illustration.

A brake, the lever of which is just visible behind the handwheel in the photograph, is provided to enable the machine to be locked with the operating lever in any desired position.

With compressed air at 100 lb./sq. in. (7 kg/cm^2) the servomotor will operate against a resistance torque of 47,000 lb. ins. (about 540 kg.M) while when moving from rest the lever is capable of exerting a torque of 70,000 lb. ins. (about 800 kg.M). This is particularly valuable in lifting single seated tight shutting H.P. steam valves off their seats and for other applications where the starting torque is high.

The power air inlet, in which a filter is mounted, can be seen on the right-hand side of the photograph, which shows the servomotor with its door open so that the control and compensating gear can be seen. This compensating mechanism is extremely simple and is similar to that used in the other Hagan servomotors. By its use a definite relationship is obtained between the control pressure received by the servomotor from a regulator or relay and the position of the operating lever. Normally a straight line relationship between these two is required, but by cutting the cam to the desired shape, any other desired relationship can be obtained.

Portuguese Superphosphate

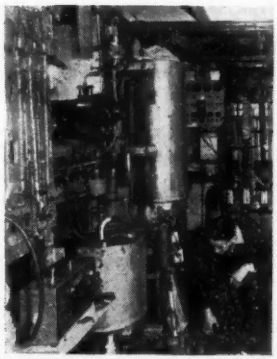
ACCORDING to a U.S. Bureau of Mines report, Portugal's Companhia Uniao Fabril (CUF) a few months ago consigned 6,000 metric tons of granulated triple-concentrated superphosphate to Greece. This shipment represents the initial production of the company's new plant at Barreiro near Lisbon, which was completed in the latter part of 1950 and has a maximum capacity of 2,000 metric tons per month.

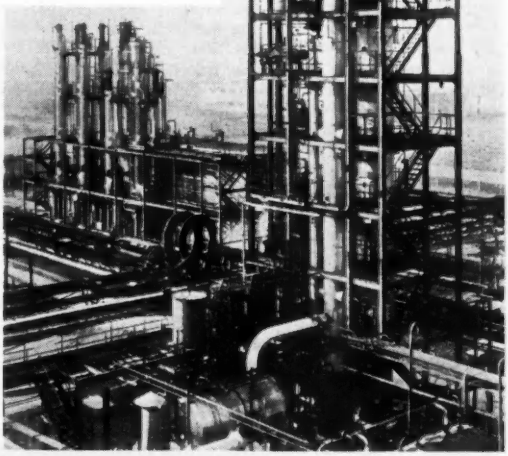
According to officials of the company, this is a new product not previously made in Portugal in which a considerably greater concentration of P_2O_5 is obtained through a reaction of phosphoric acid on phosphate rock and is obtained by the usual methods utilising sulphuric acid. The official could not say that the P_2O_5 content is actually three times as great as in the ordinary superphosphate, but stated that there is a considerably greater degree of concentration that makes the product especially suitable for export.

The Company plans to introduce the new product to the Portuguese market as soon as enough stock has been accumulated.

Chemicals from Oils

A Complete Technical & Economic Service





Section of the Petrocarbon pilot plant, and (right) part of a plant for production of ethylene oxide with an ethylene derivatives plant

Part of the research laboratories of Petrocarbon, Ltd., at Urmston near Manchester. The comprehensive work of the company and the services offered by its team of industrial and economic experts is outlined in its latest booklet 'Petrocarbon Services,' from which the illustrations on this page are reproduced

• OVERSEAS •

Swiss Sulphur Control

It has been announced that sulphur imports are to be controlled by the Swiss Federal Government as the country has found that it is not obtaining sufficient for her needs. It is thought that State control is also intended to satisfy the International Materials Conference Sulphur Committee that Switzerland will not allow private traders to re-export sulphur to countries beyond the Iron Curtain.

New Particle Confirmed

Yet another sub-atomic particle has been detected and its presence confirmed by atomic research. Carl D. Anderson, a Nobel Prize winner, of the California Institute of Technology, reports that the new particle—named the V particle because of the V-shaped track it makes in a cloud chamber—is evidently a very heavy meson that can absorb additional energy and therefore represents an excited energy state. Its life is approximately 2×10^{-1} seconds, and its decay product can be either a proton or a neutron. Its first existence was indicated by British studies made in 1947.

Monel Tanks Used

Because of its excellent physical properties and its high resistance to corrosion, monel is being used extensively in Australia for the manufacture of equipment to hold corrosive chemicals.

A Sydney company recently had six big tanks of the metal specially made to hold potassium dichromate. All were fabricated from 12-gauge monel sheet, and 16-gauge monel sheet was used for the roofs. The fabricating company employed a suitable run sequence in the manufacture, and by maintaining correct joint gaps, by the use of wedges, overcame practically all distortion of the tank bottoms. The plate joints on the bottoms were welded on both sides, and, with the use of a lead hammer and hardwood frame, flanged to a two-inch radius, to join the side plates. Angle iron sections were rolled to the correct diameters, and were used as a jig to support the side sheets during the assembly of the dichromate tanks.

Dutch Cellulose Factory

Production at the straw cellulose factory at Arnhem is expected to begin early next year. The Dutch Government owns 5/9ths of the capital, the remainder being held by AKU. Output estimated at about 1,000 tons a month is scheduled for use by the paper industry.

Mexican Iron Ore Findings

A dispatch from Mexico City states that about 15,000,000 metric tons of iron lie in a newly discovered deposit in the northwestern State of Michoacan. The National Institute for Investigation of Mineral Resources reported the findings and said the ore contains an average of 67 per cent iron. The deposit is at Cerro del Cubero, close to another recently discovered iron ore deposit.

Scientists Barred Entry to U.S.A.

A number of leading scientists who intended to attend the International Congress of Pure and Applied Chemistry which began in New York on 3 September were unable to obtain visas to land in the U.S.A. under security regulations. Among those affected, were: Mlle. Marguerite Perey, of France, discoverer of the chemical element 'francium'; Professor Mario A. Rollier, of the Polytechnic Institute at Milan; Professor Guilio Natta, of Milan's Institute of Industrial Chemistry; Steig Viebel, of Denmark.

Metal Powder Standards

Two new standards designed to aid both the metal powder producing and consuming industries as well as the metal powder parts users have been released by the Metal Powder Association. One specifies the preferred dimensions and tolerances of oil impregnated metal powder bearings, better known as self-lubricating powder bearings. The other describes a method for determining the green strength of compacted metal powders. The term 'green strength' applies to the resistance of a pressed compact to abrasion, breakage and spalling due to rough handling and to the forces resulting from the plastic deformation of dies and relative die segment movement during the pressing operation.

The Chemist's Bookshelf

THE ACETYLENE INDUSTRY AND ACETYLENE CHEMISTRY IN GERMANY DURING THE PERIOD 1939-45. B.I.O.S. Report No. 30. By the joint panel of D.S.I.R. and M.O.S. H.M.S.O. 1951. Pp. 157. 3s. 6d.

Unlike many previous publications of this type, which have been hastily compiled, indifferently arranged and with a minimum of useful information, this review is a model of concise and orderly reportage. It is divided into two sections, the first, dealing with the production and use of acetylene, being written by R. Owens, and the second, dealing with the acetylene chemistry, being written by A. W. Johnson, who has been responsible for many original publications, reviews and books upon the subject of acetylenic compounds.

There is a detailed description and discussion of the plant at Hüls which produced acetylene by the cracking of methane in an electric arc. The power consumption of this type of plant is approximately the same per unit weight of acetylene as that required by the carbide plants, and at the place and time described acetylene was produced more cheaply. The sources of methane are natural gas, coke oven gas and coal hydrogenation gas and because the German chemists have shown that a large and complex chemical industry can be based upon acetylene, the economics of the electric arc process are of very great interest. The electric arc production of acetylene would have the greatest chance of adoption when the use of coal can be reduced to the minimum, that is when it can use a source of cheap power such as hydroelectric power and when it can convert waste or natural gas.

The polymerisation of acetylene to cyclooctatetraene is fully described and the chemistry of this protean compound is given in considerable detail. As with previous reports, however, there is an unfortunate reticence upon the subject of the other condensation products which are obtained during the polymerisation. Whether this is due to the loss of documents or to the fact that very little attention was paid to them by the Reppe team is not clear.

The whole review is elaborately indexed and contains a complete list of references.

It was perhaps unfortunate and certainly ungenerous to include a section devoted mainly to the belittling of the German achievements, which have stimulated a large amount of post-war research in this and other countries.—J.R.M.

APPLIED ATOMIC ENERGY. By K. Fearnside, E. W. Jones and E. N. Shaw. London: Temple Press Ltd., 1951. Pp. 156. 8s. 6d.

This book, one of the publisher's Technical Trend Series, deals in brief but yet concise form with the application of atomic energy to peaceful purposes, which, in the shape of radioactive isotopes, has been introduced only in the last few years in Great Britain. A number of problems, however, have been satisfactorily solved by the new techniques thus made available. This book provides the basic knowledge of nuclear physics necessary to an understanding of the advantages to be derived from these techniques and it discusses in eleven systematically arranged chapters a large number of applications to different fields of pure and applied science, including radiography techniques and the use of isotopes in pure research, in biological work, industrially, for medical purposes and in agriculture. It also discusses the prospects of useful power generation and problems of international control. An appendix deals with isotopes available on a routine basis from the Atomic Energy Research Establishment, Harwell, and partly from the Radiochemical Centre, Amersham. The book contains 24 figures and 14 instructive plates and its information, obviously made available and compiled from both American and British sources, will be of great interest and value to scientists working in other fields, to the intelligent layman and to the student.—F.N.

HOME

Avonmouth Oil Fire

The disastrous oil fire which broke out at Avonmouth on Thursday last is now happily under control. Over 100,000 gallons of spirit were at one time free inside the walls of the Regent Oil Company's compound where the fire originated. Nine of the company's tanks were destroyed, involving a total of 10,000,000 gallons of spirit, and it is expected to be fully 12 months before the compound is in working order again. The total number of civilians and firemen injured was 110-130, but these were all minor injuries. The bodies of the two dippers who were at the source of the fire when it began have since been recovered. Dr. H. E. Watts, His Majesty's Chief Inspector of Explosives, has been appointed by the Home Secretary to make an inquiry into the fire. The possible reintroduction of wartime safety measures was referred to by the Home Secretary when he visited the site on 11 September.

British Pharmacists Conference

Some 600 delegates were received by the Mayor of Harrogate, Councillor N. A. Foster, in the Royal Hall on Monday evening, 9 September, on the occasion of the opening session of the British Pharmaceutical Conference. The science sessions, under the chairmanship of Professor H. Berry, dean of the school of pharmacy, London University, began on the following day. The 21 papers to be read were mainly from the research departments of manufacturing chemists and the universities.

Chemical Microscopy Meeting

The Microchemistry Group of the Society of Public Analysts will hold a joint meeting with the Liverpool and North-Western Section of the Royal Institute of Chemistry on Thursday, 18 October and members of the North of England Section of the Society of Public analysts have been cordially invited.

Afternoon visits have been arranged to Port Sunlight and J. Bibby and Sons, Ltd. Papers on microscopical analysis, fluorescence microscopy and polarisation microscopy will be read and discussed at the evening meeting which will be held in the Chemistry Lecture Theatre, University of Liverpool.

Oil Electricians End Strike

Over 100 electricians employed on the oil refinery at Fawley, Southampton, who began an unofficial strike on 3 September, returned to work on 10 September, Mr. R. J. Cole, project manager for the main contractors, said that it had been agreed that the management and the Confederation of Shipbuilding and Engineering Unions should meet at an early date to discuss wages.

Catalogue Prices Advanced

The British Drug Houses, Ltd., have announced that they have been reluctantly forced to advance their current catalogue prices of B.D.H. and 'AnalaR' laboratory chemicals by 12½ per cent.

Increases in the cost of wages, transport and fuel have come into operation in recent weeks which affect the cost of all the products the firm supply, and which it is impossible for them to absorb without a general increase in selling prices.

A new edition of their catalogue, which will incorporate a detailed revision of prices, will be published as early as is practicable in 1952.

Public Analysts to Meet

An ordinary meeting of the Society of Public Analysts will be held at 7 p.m. on Wednesday, 3 October, in the Meeting Room of The Chemical Society, Burlington House, Piccadilly, London, W.1. Papers will be presented on the micro-volumetric determination of iron, the inefficiency of dessicators and the analysis of copper base alloys. Guests introduced by members will be welcomed.

Harmful Effects of Pest Control

Indiscriminate application of insecticides in countries with highly organised pest control services was referred to by a German delegate, Mr. Otto Palm, of Munich, at the International Congress of Beekeepers at Leamington Spa. Mr. Palm suggested a world campaign to reduce the intensive pest control methods which he claimed, were having disastrous effects on the bee population.

American Chemical Society

Diamond Jubilee Celebration

CELEBRATING its Diamond Jubilee, the American Chemical Society has held the largest meeting in its history in New York during the last two weeks. Some 18,000 chemists from 43 nations attended and participated in the various meetings of the world chemical conclave, representing the 120th national meeting of the American Chemical Society and the Twelfth International Congress of Pure and Applied Chemistry. Many hundreds of papers were presented dealing with every phase of chemical activity, emphasising the contributions to better living constantly being made by chemists all over the world.

Dr. James Bryant Conant, president of Harvard University, one of the key speakers, in an address entitled 'A Sceptical Chemist Looks into the Crystal Ball,' declared that we were in the midst of a chemical revolution and that the work of the chemist in the United States had only just begun. The breadth of the chemist's scientific training and the strategic position of his science, Dr. Conant said, 'will make him one of the key figures in an urbanised, mechanised society dependent for its very life on the careful control of a multitude of chemical reactions.'

Noting his scepticism of the claims of what he called the modern alchemists—that it, the atomic physicists—Dr. Conant prophesied that there would be no atomic holocaust, nor would the next 50 years see the 'golden abundance of an atomic age.' By the end of the century, he said, solar energy, rather than atomic energy, would be the dominating factor in the production of industrial power. He also predicted that with the availability of cheap power, fresh water would be readily produced from sea water thus turning desert areas adjacent to seacoasts into garden spots.

Not Only Liquid Fuels

In the field of industrial chemistry he predicted that early in the second half of the 20th century chemists would be commercially producing not only liquid fuels but all manner of chemicals from carbon monoxide and hydrogen.

In another memorable speech, Dr. H. Howell Furman, president of the American Chemical Society and chairman of the chemistry department of Princetown University, predicted that in the next 25 years 'more chemists will be busy with a study of the chemistry of life processes in plants and animals than with any other general area of research.' When chemistry is more fully understood, he said, 'we can look forward with assurance toward the conquering and alleviation of our remaining physical ills.' He predicted that factories one day would turn out the food that plants now make. This would be achieved when chemists learnt the secret of photosynthesis, the process by which plants used the energy of the sun to combine water and carbon dioxide into sugar and starch.

Recovery of Pickling Acid

A new sulphuric acid recovery process for steel mills, oil refineries, and titanium pigment plants, might help ease the sulphur shortage, F. J. Bartholomew of the Chemical Construction Corporation, New York, told the meeting. The new process recovers 85 to 90 per cent of the acid normally discarded in the 'pickling operation' of a steel mill, including the acid contained in the iron scale and rust.

The method involved separation of the iron sulphate by crystallisation, after concentrating the liquor by submerged combustion in a special burner in which oil flames blaze beneath the surface of the liquid. The sulphate is filtered out of the liquid on a plastic filter supported by a lead frame. This sulphate is mixed with coal and roasted to produce sulphur dioxide gas, which can easily be converted back into sulphuric acid and iron oxide. The oxide can then be returned to the blast furnace.

Decontamination of radioactive water to make it safe for drinking after an atom bomb attack might be possible through the use of ion-exchange resins, according to a report made by Dr. W. P. Utermohlen and M. E. Gilwood of the Permutit Company, New York. The ion exchange process was the best yet described for deactivating water exposed to atomic radiations. The oldest and most important ion-exchange medium was

the soil—the success of the application of fertilisers to soil was thought to be due to ion-exchange activity.

Man-made synthetic resins were first developed early in the 20th century. The first commercial synthetic resins were similar to the active ingredients found in the soil. The most important use of the synthetic resins at present was in the softening or demineralising of water. The resins were useful industrially, as they reduced scale deposits in boiler and heating units.

Used in the War

Ion-exchange resins, the lecturer continued, were used during the war to treat sea water, making it potable for emergency use. Millions of these de-salting kits were used in military planes, life-boats and small auxiliary craft. The present de-salting kits would produce seven times their own volume of pure water from sea water.

The resins had also been found useful in cleaning up industrial waste waters, both to recover valuable by-products and to prevent stream pollution. The special properties of some of these resins had made possible the present purity and mass production of streptomycin and other antibiotics. Ion exchange demineralisation was also used to purify glycerine for food and drug use.

Heat treatment of plastics to give them their desired properties, by using methods similar to those now employed with metals, was reported by Dr. Fraser P. Price, a chemist associated with the (U.S.) General Electric Company's research laboratory. Plastic crystals, he said, might be made to form by proper application of heat in a manner closely analogous to crystal formation in a metal such as steel. In the plastic, as in the metal, each crystal forms around a nucleus of some foreign matter, or dirt.

Dr. Price's research was concerned with a fluorine-containing plastic—polychlorotrifluoroethylene. As prepared, it was in the form of clear sheets. If heated to more than 400°F., at which it softened and became rubbery, and then allowed to cool slowly, the sheet became cloudy.

Studies of this cloudy plastic by special microscopes, X-rays and other methods, revealed many tiny circular groups of crystals, each group a hundredth of an inch or less in diameter. The electrical and mechanical properties of the plastic containing crystals were very different from those of the normal form, where there are no regular order in the arrangement of the atoms of which it was made. In a crystalline material they were arranged in a regular lattice. The crystal formation occurred mainly at temperatures above 350° F. The nuclei, around which the crystals formed, were provided by the 'filler' that was added to the plastic in manufacturing.

Similar effects occurred with many types of plastics including nylon and polyethylene, which was widely used as a transparent covering. In discussing possible applications of his work, Dr. Price said that choice of the proper heat treatment and filler might afford means of regulating the properties of a plastic. For example, if a plastic of considerable tensile strength were desired, many crystals might be formed. If, on the other hand, it was desired to have one that could be flexed back and forth a great number of times, without as great resistance to being pulled apart, the non-crystalline form might be preferred.

Similar methods were widely used in the heat treatment of metals. They might be heated, then cooled, and held for a certain time at a lower temperature. This induced formation of crystals of the size and distribution needed to give the qualities that were required.

Plastic Terms Standard

THE British Standards Institution have just published B.S.1755—'Glossary of Terms Used in the Plastics Industry.'

This is one of the documents in the series which is being prepared to cover glossaries of terms used in various industries and it is hoped that it will provide for greater uniformity and precision in the use of terms.

The document is of considerable importance at this juncture as it will form a basis for discussions on an international level by Technical Committee 61—Plastics—of the International Organisation for Standardisation. The terms are grouped in sections to cover: chemistry, industrial applications, constituents, properties, moulding processes, and other manufacturing processes. The terms listed in these sections are fully defined.

Copies of this standard may be obtained from the British Standards Institution, Sales Department, 24 Victoria Street, London, S.W.1, price 6s. post free.

Publications & Announcements

A NEW bulletin on British-built super centrifuges has recently been published by Sharples Centrifuges Ltd., of Gloucestershire. After describing the principles of a centrifuge the bulletin gives details of a range of Sharples continuous centrifuges which are claimed to develop the highest centrifugal force commercially available. The force attained is 13,200 times gravity. The centrifuges are designed to effect separation of solids from liquids, of immiscible liquids of different specific gravities from each other, and of liquids from solids. Comprehensive details are given of their operation, design, and maintenance.

* * *

SOME heavy pattern screwed cap gland cocks for vacuum and high pressure work in the chemical industry are described in a leaflet published by B. Rhodes & Son, Ltd., of Romford, Essex. Points noted in the design of these cocks are: zinc-free phosphor bronze where resistance to corrosion is required; full area way; straight through way in plug—no cored cavities; large diameter plug with good cut-off; long bearing surfaces at top and bottom of plug; accurate boring of barrels and turning of plugs on modern machine tools; careful grinding of surfaces; large stuffing box with deep packing space, and extra thickness in the walls. For holding vacuum, the screwed cap gland gives an even pressure round the packing and is preferred for this reason, say the company; bolted type gland cocks can also be supplied in gunmetal, bronze, monel, nickel and stainless steel.

* * *

THE results of more than 25 years of laboratory and field study by the technical staff of the company on the nature of corrosive attack on copper and copper alloys have been published by the American Brass Company, Waterbury, Conn. This publication, believed to be the first of its type in the industry, explains the chemical and physical nature of corrosion in its various forms. Among the subjects discussed are theory of corrosion, discussion of corrosion-resistance, rating charts, typical industrial uses of copper alloys, composition, mechanical and physical properties of alloys, welding rods and a questionnaire on process conditions. The booklet is well illustrated with significant photomicrographs. The tabulation indicating the relative corrosion-resistance of the principal types of copper and alloys, when in contact with 183 different corroding agents, should prove most valuable to material engineers in selecting copper alloys best suited for a specified use. This 24-page booklet entitled 'Corrosion Resistance of Copper and Copper Alloys (Anaconda Publication B36)' may be obtained from the American Brass Company, Waterbury 20, Conn.

* * *

FOLLOWING the successful introduction earlier this year of their 'Radian' (new type) electrode for mild steel welding, The Quasi-Arc Company Ltd., of Bilston, Staffordshire, have now issued a six-page technical circular giving details of the mechanical properties and chemical composition, welding technique, deposition and packing data, as well as the applications and characteristics of the electrode.

* * *

A SAFETY valve claimed to be of great importance to chemical manufacturers and industrial plant engineers is described in a pamphlet recently issued by B. Rhodes & Son, Ltd. These valves, designed by a chemical plant chief engineer of 35 years' experience are claimed by the makers to overcome the two most serious difficulties met with in ordinary safety valves—inefficient sealing and the danger of seizing up. The 'Sergeant' safety valve ensures no loss of vacuum by an effective oil seal in which slab oil, liquid paraffin, or other liquid suitable to the process can be used. In order to prevent sticking, spiral grooves are cut in the valve spindle, which are oiled from a cup in the cover bearing, and provision is made for easily rotating the valve on its seating. Maintenance records can ensure that these operations are regularly carried out. The design of the valve is such that there are no hinge pins or connections liable to seize up—instead there is a link piece with knife edges working in V grooves—and where a spring is fitted for higher pressures, it is mounted in such a way as to avoid encrustation with chemicals. The load on the valve is a 'floating load,' thereby ensuring operation.

THE series of alloys formed by nickel and iron is remarkable for its wide range of magnetic and thermal characteristics. To supplement the full description of magnetic characteristics contained in an earlier publication, the Mond Nickel Company has recently issued a comprehensive summary of those associated with thermal changes, under the title 'The Physical Properties of the Nickel-Iron Alloys.'

This publication, obtainable free of charge from the Company, gives data on the tensile strength, hardness and electrical resistance of the binary alloys and on the elastic and expansion properties of both the binary and the more complex alloys. A section dealing with the applications of the alloys describes their use for a variety of temperature-control devices, for expansion-control in engineering components and for glass-to-metal seals. Much of the material is presented in the form of graphs and a comprehensive bibliography is included.

* * *

A BUYER'S guide to Swiss chemical industry has just been publishel by Verlag Für Wirtschaftsliteratur GMBH, at a price of 30s. It is printed in both French and German, and has sections on fine chemicals, pharmaceuticals, cosmetics, aromatic extracts, soaps, dyes, mineral oils, rubber, gas, glass, etc. It has an index to firms at the back, and may be obtained from F. C. Urbach, 63 Lancaster Grove, London, N.W.3.

* * *

THE second in the series of lectures, monographs and reports published by the Royal Institute of Chemistry in 1951 has recently been issued. It is a transcription of the 12th Gluckstein Memorial Lecture, 1951, given by Edward A. O'Neal, chairman and managing director of Monsanto Chemicals, Ltd., on 'Organisation for Development in a Chemical Company'. In it, Mr. O'Neal suggests means for overcoming some of the present shortcomings in the development capacity of chemical industry, by proper organisation, with the object of increasing efficiency to the maximum and minimising waste. Organisation, he said, must provide firstly for the creation of new ideas for new fields, for commercial exploitation; secondly, for the reception and working out of those ideas; and thirdly, for the provision of process improvement and application research. All three should find their realisation in a trisectional research department.

THE Chemicals Division of The British Oxygen Co., Ltd., have issued a specification for their melamine, or 2,4,6-triamino-1,3,5-triazine. Free from lumps or mechanical impurities, say the company, its loss at 105°C. is 0.2 per cent maximum, ash 0.1 per cent maximum, and the *p*H of its liquid extract 7.0 to 7.5. Assay is not less than 98 per cent.

* * *

ISOPAD, Ltd., announce the successful development of an 'Isomantle' which can accommodate any size of flask. Previously separate mantles were necessary for every flask size, a less satisfactory arrangement, but now any flask from 50 to 500 cc. will fit into the MUL/500 size, and type MUL/2 will take any flask from 250 to 2,000 cc. Also, both round and flat-bottomed flasks can be used, and the apparatus will heat funnels as well.

* * *

QUICKFIT & Quartz, Ltd., the laboratory and industrial chemical glassware manufacturers, announce that they have started quantity production of a 200-litre flask, believed to be the largest flask ever made.

It is thought that the flask will make a valuable contribution towards increasing the scope of industrial chemical plant, particularly in manufacture of the latest drugs and fine chemical products.

'It is only a few years ago that 20-litre flasks were considered to be very large vessels by manufacturers and users alike', commented Mr. B. H. Turpin, Quickfit & Quartz's technical and sales director. 'It is a measure of British craftsmanship that we are now dealing with 200-litre flasks'.

* * *

ANOTHER new magazine entitled 'At the ROOT of it All' has just been published by the National Coal Board. Printed in three different colours on the cover, it sets out to explain the fundamental nature and uses of coal, from the raw materials it contains to the plastics, insecticides, dyes and multitude of other finished products it supplies indirectly. The magazine is excellently planned and laid out, but surely stories about coal have been plugged enough through the Festival of Britain and countless other publicity organs without the National Coal Board bending itself to this task. The function of the Coal Board should be to produce coal, not expensively produced journals at someone else's expense.

Gaskets, washers, sealing rings and packings of "Klingerit" do not fall down on the job—and on present-day oil processing installations where the temperature of the crude oil often reaches 900°F., that is saying something!

"Klingerit" will not soften or squeeze out however highly compressed, however great the pressure, and will resist the seepage of the most searching hydrocarbons . . . But we suggest you send for the "Klingerit" data book, and a sample of the jointing itself.

"Klingerit"

JOINTING

RICHARD KLINGER LIMITED

KLINGERIT WORKS, SIDCUP, KENT. TEL: FOOTSCRAY 3022

Benn Brothers, Limited

Influence of the Trade Press

THE fifty-fifth annual general meeting of Benn Brothers, Limited, the publishers of THE CHEMICAL AGE, was held on 31 August at Bouverie House, Fleet Street, London.

Mr. E. Glanvill Benn, the chairman, in the course of his speech, said:—

It has been said that the Government is a sleeping partner in every business, but, unlike the normal sleeping partner, it has made no contribution to the assets of the business, nor does it shoulder any risk. Yet its rewards are great. Our consolidated profit and loss accounts for the three years just ended show amounts set aside for the Government of £174,952 and net for the shareholders of £78,548.

Last December the share premium and part of the general reserve were used to pay for a bonus issue of Ordinary shares. Already, however, we have been able to build up the general reserve once more, and if the allocations recommended by the directors are approved this will stand at £142,000.

Current assets now amount to £518,527 and current liabilities to £153,199, leaving a working surplus of £365,328.

Compared with a year ago, you will have noticed also that at the date of the balance-sheet we owed printers and papermakers and other suppliers rather less than in 1950, while our advertisers, newsagents, and other customers owed us rather more. This is a healthy tendency and a sign that trading conditions are returning to normal.

Politicians Hopeless

At annual meetings of this company since the war I have criticised politicians and Government officials for interfering with trade, continuing controls which may have been necessary in war-time but are certainly not necessary now, and generally making difficulties for the business community. The latest political stunts, such as the proposed abolition of retail price maintenance and dividend limitation—the Command Paper on this subject being distributed through the trade at 3d. net, that is price maintained, ironically enough—show that no amount of criticism or constructive guidance will change the opinions of men whose ideas are fixed in advance and who refuse to learn by experience. Those of us who look to a happier future must pin our faith in a new generation whose motto will no longer be 'safety first.'

A study of the advertisement pages of our 15 journals shows clearly that business undertakings of all sizes are struggling ahead, selling British goods in all the markets of the world in spite of the worst that the politicians can do to them. Let us hope that the merchant venturers of to-day will soon again be backed and supported by a proud Government, instead, as now, of being the subject of abuse by some, bad jokes by others, and treated by those who boast of being 'our masters' as geese who lay the golden eggs.

Interesting Trend

The same study of our advertisement pages reveals another interesting trend. Whereas during, and for some years after the war, most advertisements were of a prestige or reminder character, now there are goods to be sold and trade Press advertising is again coming into its own as one of the most effective weapons in the armoury of the Sales Department.

One of our journals; our subsidiary company, Ernest Benn Limited; and another concern with which the book company is closely associated, all made small losses. These losses do not alarm your directors, but they may serve to remind shareholders and others that publishing is a highly speculative business. Good profits and good dividends are the fair and proper recompense for the equal risk of large losses.

This is the sixth time I have had the privilege of presiding at an annual meeting and as each year goes by my personal debt to all the workers in Benn Brothers Limited and its associated companies increases. No chairman has a better team around him, and shareholders will wish to join me in expressing our gratitude to the men and women who by their service have enabled us to produce the report presented to-day. The man who ought to be most grateful of all to them is Mr. Gaitskell, but he apparently prefers to reward those who have steadily defied the Government's wishes, and to penalise the rest.

PERSONAL

The Pulsometer Engineering Company Limited, have announced the appointment of the following directors: SIR FELIX POLE, who will take the chair at board meetings in place of Mr. Eliot Hodgkin who has resigned, MR. R. G. W. BLISS, and MR. A. V. PRICE. MR. J. ELLIOTT has been appointed secretary.

MR. WALTER B. MORS has been chosen by competitive examination from research workers from the whole of Brazil, to attend the International Chemical Conclave now taking place in New York. Mr. Mors is a member of the staff of Productos Evans Soc. Anon., the associate company in Brazil of Evans Medical Supplies Ltd.

MR. GRAHAME MARTIN TURNER, a director of Thomas De La Rue & Co., Ltd., left London on 3 September for a 30,000-mile tour of New Zealand and Australia. Mr. Martin Turner will study the scope for the application in Australasia of Formica, his company's laminated plastic, particularly for use in hospitals, surgeries, dispensaries and other clinical or surgical spheres.

He flew to Auckland via New York and San Francisco and will be away about ten weeks, leaving Darwin for an extended homeward journey on 4 November. In October he will attend Formica Sales Conventions at Sydney and Melbourne.

What is claimed to be a national long-service record was honoured at the Dorchester Hotel on 11 September, when 64-year-old MR. HARRY ADKINS junior, celebrated the completion of 50 years' employment with one firm—for with him will be his father, MR. HARRY J. ADKINS senior, B.E.M., 89 years old and still working, with the same company, after 76 years.

MR. BERNARD C. WESTALL, C.B.E., chairman of Thomas De La Rue & Co., Ltd., in whose company both men have spent their working lives, believes that this 126 years' father-and-son combined unbroken service is a record.

At the celebration Mr. Adkins junior, will become a member of the Delarunarian Club, membership of which is limited to men and women who have been with De La Rue for 50 years or more. Three other working veterans—MESSRS. T. W. DADEN, E. C. WICKENS and S. CLARK—are also to be welcomed to the club. Each will receive a silver salver and a cheque.

MR. J. G. WOODS has been appointed manager of Mathieson Hydrocarbon Chemical Corporation's plant at Doe Run, near Brandenburg, Kentucky. Mr. Woods, who is 39, took a chemical engineering degree at the University of Texas. In the late '30s he was for several years with the Humble Oil Company, and before joining Mathieson Hydrocarbon in September 1950, he was superintendent of the Dow Chemical Company's ethylene plant at Freeport, Texas.

At their meeting on 6 September, members of the Council of the British Engineers' Association elected as their president for the year 1951/52, MR. DAVID D. WALKER, M.A., M.I.E.E., who is joint managing director of Messrs. Evershed and Vignoles, Ltd., chairman and managing director of Messrs. Thomas Walker and Son, Ltd., and a director of Messrs. J. B. Brooks and Co., Ltd. He is also a Member of the Council of the British Electrical and Allied Manufacturers' Association.

The Council re-elected as vice-president, MR. H. S. 'DICK' BROOM, M.B.E., B.Sc., M.I.Mech.E., joint managing director of Messrs. Broom and Wade, Ltd., a director of B.E.N. Patents, Ltd., a member of the executive committee of the Federation of Manufacturers of Contractors' Plant and a member of the council of the Industrial Welfare Society.

Obituary

The death was reported on 3 September of MR. RICHARD JONES DAVIES, B.Sc., former commercial manager of Imperial Chemical Industries, Ltd., Grangemouth. Mr. Davies, who retired three years ago, was formerly stores manager with Scottish Dyes, Ltd., Grangemouth, and on its acquisition by I.C.I. became manager and chief accountant.

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

C. WAKEHAM & SON, LTD., Helston, chemists. (M., 15/9/51). 16 July, debenture, to Barclays Bank Ltd., securing all moneys due or to become due to the bank; general charge.

Satisfactions

DUGUIDS, LTD., Lymm, manufacturers of scientific apparatus, etc. (M.S., 15/9/51). Satisfaction 20 July, of mortgage registered 15 May, 1942.

Company News

Petrochemicals, Ltd.

Planning, building and bringing into production, all in one great operation, some 17 plants of which several were of completely novel design, was an achievement of which the company might be justifiably proud, said Sir Robert Renwick in his address as chairman of Petrochemicals, Ltd., at the fifth annual general meeting held in London on 6 September. The meeting was to consider accounts for the year ended 30 June, 1950. The delay in presentation was due to the complexity of the building period now nearing completion, and it was hoped the accounts for the year ended 30 June, 1951, would be available more quickly.

The period since September, 1950, had been one of real progress, and many technical problems had been overcome. All the individual plants were now in operation and on the aromatic side, production targets had been achieved. Performance of the gas-conversion plants had improved steadily. Production of ethylene oxide was operating smoothly, although output might be limited by shortage of chlorine deliveries. Corrosion difficulties had arisen in connection with the isopropanol plant, but it was hoped full production would soon be attained. The Catarole furnaces which convert the charging stock into gas and an aromatic liquid called crackylate continued to operate satisfactorily.

Methods of transporting certain highly inflammable liquids first employed by the company were now being adopted by other leading manufacturers.

Referring to subsidiary and associated companies, the chairman said, that the plant of Styrene Products, Ltd. (in which Petrochemicals had a 60 per cent interest), came into production in December, and that of Styrene Co-Polymers, Ltd. (owned jointly with Lewis Berger & Sons, Ltd.), started initial production this spring.

An accumulated debit in excess of £2,000,000 must be expected for the financial year ended 30 June, 1951 due to the heavy running-in losses, but is was reasonable to expect that current revenue expenditure would be covered by current income before the end of 1951; during 1952 net earnings after providing for depreciation, should more than cover interest on outstanding loan stocks and indebtedness.

Market Reports

LONDON.—A steady demand has been maintained in all sections of the industrial chemicals market and export inquiries have been on a good scale. In so far as supplies are concerned the general position is unchanged while prices display a firm undertone with quoted rates showing no alteration. Chlorate of soda, caustic soda and bichromate of soda are all moving steadily into consumption and there is a ready outlet for all the potash chemicals.

MANCHESTER.—Except that holiday influences are now very little in evidence, there has not been much change in conditions on the Manchester chemical market. The past week has witnessed a brisk demand for most descriptions of heavy products from home users, who are also circulating steadily delivery specifications under contracts. The export outlets are also pressing for supplies and a fair amount of new overseas business has been reported. Values are firm in virtually all sections of the market. The call for fertiliser materials is on the slow side, but there is an active demand for both light and heavy tar products.

Forthcoming Events

TUESDAY 18 SEPTEMBER

Incorporated Plant Engineers

Edinburgh: Chamber of Commerce, 25 Charlotte Square, 7 p.m. W. M. Greenhorn: 'The Construction of a Modern Oil Refinery.'

WEDNESDAY 19 SEPTEMBER

Incorporated Plant Engineers

Bristol: Grand Hotel, 7.15 p.m. Dr. E. G. Ritchie, president elect: 'Steam Peaks and Thermal Storage.'

International Scientific and Technical Conferences

Italy: Rome, 15-21 September. 18th International Conference on Documentation.

Holland: The Hague, 15-22 September. 5th Congress of the International Film Association.

Italy: Venice, 16-22 September. Autumn meeting of the Institute of Metals to be held in conjunction with the Italian Society of Metallurgy.

U.S.A.: Appleton, Wisconsin, 17-21 September. International Pulp and Paper Symposium.

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

A **CHEMICAL ENGINEER** is required by well known chemical manufacturers in South Lancashire. The vacancy is in the Design and Development Department, and offers considerable scope for advancement. The work is varied and interesting, and calls for a thorough knowledge of the fundamentals of chemical engineering. Candidates should be well qualified, with preferably A.M.I.Chem.E. Applicants should write to Box No. C.A. 3042, THE CHEMICAL AGE, 154 Fleet Street, London, E.C.4.

MINISTRY OF FUEL AND POWER: EXAMINER (MALE). The Civil Service Commissioners invite applications for two permanent appointments in the Gas Standards Branch.

Candidates must be at least 25 years of age on 1st August, 1951. They must possess a university Degree in either physics or chemistry. Some post-graduate research experience would be an advantage.

Salary scale £475-750. Starting pay is linked to age 25, with addition of £25 for each complete year of age above 25, subject to a maximum of £600.

This salary scale is at present under review.

Further particulars and application forms from **The Civil Service Commission, Scientific Branch, Trinidad House, Old Burlington Street, London, W.1**, quoting No. S4073/51. Completed application forms must be returned by 18th October, 1951. 12808/120/MLB.

OIL Refinery Contractors handling large contracts for refinery plant require **CONTRACTS ENGINEERS** in their London office. Duties involve broad direction and co-ordination of all phases of the work, including planning, drafting, purchasing, progressing and erection. Desirable qualification is previous experience, including a wide knowledge of pumping, heat exchange equipment and instrumentation, and the appointments offer excellent prospects to suitable men. Applicants should write fully, stating qualifications, age and experience to **Foster Wheeler, Ltd., 3 Ixworth Place, London, S.W.3.**

FOR SALE

CHARCOAL, ANIMAL and VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal insulating; also lumps ground and granulated; established 1830; contractors to H.M. Government.—THOS. HILL-JONES, LTD., "Invicta" Mills, Bow Common Lane, London, E. Telegrams, "Hilljones, Bochurch, London." Telephone 3285 East.

'PHONE 98 STAINES

LABORATORY Duplex "Z" Blade **TIPPING MIXER**—5½ in. by 4 in. by 4½ in. deep.

"Werner Pfliederer" Jacketed Twin-blade **TIPPING MIXERS**—29 in. by 27 in. by 19 in. and 25 in. by 25 in. by 20 in. deep.

FILM DRYERS or **COOLING ROLLS**—9 ft. by 4 ft. diam.

Copper Jacketed **VACUUM PAN**, elec. vac. **PUMP** and **CONDENSER** by "Blair Campbell"—pan 7 ft. by 3 ft. diam.

HARRY H. GARDAM & CO., LTD., STAINES

LABORATORY TEST SIEVES TO B.S 410: 43 or commercial quality, ring or write for brochure. ENDECOTTS (FILTERS) LTD., 251, KINGSTON ROAD LONDON, S.W.19. LIBERTY 8121/2.

FOR SALE

VARIOUS MIXERS FOR SALE

BAND CONVEYOR, 50 ft. long 40 in. wide, steel frame motorised, for boxes, cases, bags, etc.

Two **FILTER PRESSES** fitted with wood plates and frames, washing type.

Two **FILTER PRESSES,** chamber type, steam heated centre fed with separate outlet taps.

14 various open top **STORAGE TANKS,** riveted capacities from 300 gallons to 9,800 gallons, last used for oil or varnish.

1½, 2½ and 3½ size belt-driven **DISINTEGRATORS** by Christy & Norris or Harrison Carter.

Size No. 3 Junior Hammamac **HAMMER MILL** with fan and cyclone, also No. 1 size Miracle **GRINDING MILLS** and one size 3W Miracle **GRINDING MILL.**

Robinson 3-sheet No. 1 size **CENTRIFUGAL DRESSING MACHINE** for dry powders, etc.

Gardner Size "G" **RAPID SIFTER** and **MIXER,** belt and gear driven.

Two Gardner **RAPID MIXERS** only, 40 in. long, 14 in. wide, one provided with small separate A.C. Motor.

Four **ROTARY BOWL MIXERS,** 5 ft. diam., cast iron built, inclined agitators, by Baker Perkins.

One Broadbent under-driven **HYDRO EXTRACTOR** self-balancing type, with self-contained A.C motor.

Two **FILTER PRESSES,** fitted recessed C.I. plates, 40 in square, 2½ in. thick, centre fed, to make 11 cakes per Press.

Kek **GRINDING MILL,** square pin type, with grinding discs 13 in. diam., including circular delivery bin with single outlet.

Large unjacketed **WERNER MIXER,** belt and gear driven, hand tipping, double "Z" arms, pans 53 in by 45 in by 36 in. deep.

No. 200 One nearly new **WERNER PFLEIDERER JACKETED MIXER OR INCOPORATOR.** Low type, with C.I. built mixing chamber, 28 in. by 29 in. by 27 in. deep, with double "U"-shaped bottom which is jacketed, and double fish-tail or fin-type agitators geared together at one side, with belt-driven friction pulleys, 34 in. diam. by 5 in. face, with hand-wheel operation and hand-operated screw tilting gear. Machine fitted with machine-cut gears, covers, gear guard, cast-iron baseplate, and measuring overall approximately 7 ft. by 6 ft. by 4 ft. high to the to of the tipping screw.

No. 209 One **HORIZONTAL "U"-SHAPED MIXER** steel built, riveted, measuring about 8 ft. 3 in long by 3 ft. wide by 3 ft. 3 in. deep, with horizontal shaft, fitted with bolted-on mixing arms about 18 in. long by 4 in. wide, with intermediate breakers, and driven at one end by a pair of spur gears, with countershaft, fast and loose belt pulleys, outer bearing and plug cock type outlet at the opposite end, mounted on two cradles fitted to two R.S.J. running from end to end.

Further details and prices upon application

Write RICHARD SIZER LIMITED, ENGINEERS CUBER WORKS, HULL

FOR SALE

600

HORIZONTAL single trough **STEAM JACKETED MIXER** by Scott. 14 in. long by 4 ft. 6 in. deep with 4 ft. 6 in. wide. Of rivetted M.S. W.P. 50 lb. sq. in. T.E. with 24 in. by 18 in. manhole in cover. F. and L. pulley drive through worm gearing.

Totally encl. **MIXER,** approx. 6 ft. int. diam. by 6 ft. deep on straight, 3 ft. hemispherical bottom. Domed cover. 6 in., 4 in., 3 in., 2 in. and 1½ in. connections to cover, with 18 in. diam. hinged manway. Three 2 in. connections in side, and 5 in. and 3 in. bottom outlets. F. and L. pulley drive.

S. J. VACUUM MIXER by Bartle. Int. dimens. 3 ft. 6 in. by 2 ft. 6 in. by 3 ft. 3 in. Perf. paddle type agitators fitted to 2½ in. diam. shaft. 1 in. bottom outlets at each end. Close fitting lid, bolted. F. and L. pulley drive

Baker Perkins trough tilting **MIXER.** Alloy trough 20 in. by 14 in. by 17 in. deep with cover Gunmetal gate type Agitators. F. and L. pulley drive.

42 in. diam. **HYDRO EXTRACTOR** by Manlove Alliott. Self balancing, solid mounted type. Copper basket 15 in. deep, ¼ in. perfs. Belt driven. 7-h.p. required to drive.

Pfaudler Blue Glass lined **EVAPORATING PAN** 36 in. diam. by 11 in. deep. Welded construction. Steam jacketed. W.P. 30 lb. sq. in.

Lead lined **STORAGE TANK** 9 ft. diam. by 35 ft. long. Of welded M.S. plate, with 18 in. diam. manhole. Two 4 in. and one 3 in. flanged connections.

GEORGE COHEN SONS & CO., LTD.
SUNBEAM ROAD, LONDON, N.W.10.
Tel.: Elgar 7222 and
STANNINGLEY NR. LEEDS
Tel.: Pudsey 2241

SAVE labour with **THE NEW MECHANICAL BARROW,** Skips and platforms for all purposes. **SELWOODS 46, CHANDLER'S FORD, HANTS.**

SCREENLESS PULVERIZERS for fine grinding of Chemicals. Also **CYCLONES, ROTARY VALVE FEEDERS. Callow (Engrs.) Ltd., Kirkby Trading Est., Liverpool.**

SEVERAL new **LABORATORY FUME CUPBOARDS,** recently manufactured by Messrs. Andrew Bros., Bristol, surplus to M.O.S. requirements, length 6 ft., height 4 ft., width 4 ft. 3 in. **WOODFIELD & TURNER,** Burnley. Tel.: 3065.

SODIUM SULPHITE, yellow tint £2/11/-, /100 kilos F.O.B. Dunkirk. Write or Cable: **SFEC, Limoges France.**

THREE—3,500 gall. capacity cylindrical **STORAGE TANKS** for sale, lagged and fitted with steam heating coils.
WILLIAM R. SELWOOD, LTD., CHANDLER'S FORD, HANTS.

TWO excellent Baker Perkins **KNEADING MACHINES** and three Ditto by Dobson & Barlow, with cast iron jacketed containers, 53 in. long by 44 in. front to back, double "Z" arms geared at each end triple driving pulleys and counterbalanced tipping gear driven from separate self-contained Worm reduction unit.

Four vertical welded **MIXING PANS,** steam jacketed, 4 ft. diameter, each 180 gallons, with top driving gear and bottom outlets. Exceptionally good machines for delivery few weeks time. Prices reasonable.

RICHARD SIZER LIMITED,
CUBER WORKS, CORNWALL STREET, HULL
or **21 DALE STREET, LIVERPOOL**

FOR SALE

3 M.S. Welded Jacketed **PANS,** 24 in. diam. by 26 in. deep, 1½ in. bottom outlet, mounted on angle legs. Tested 100 lb. hydraulic pressure.

THOMPSON & SON (MILLWALL) LIMITED
CUBA STREET, LONDON E.14.
Tel. East 1844

8 COPPER-jacketed **MELTING PANS,** 18 in. diam. by 12 in. deep, fitted covers, mounted in M.S. frames 25 in. by 25 in. by 44 in. high, with flanged fittings, valves and steam traps. As new.

THOMPSON & SON (MILLWALL) LIMITED
CUBA STREET, LONDON, E.14.
Tel. East 1844

FOR SALE

4,000 gross string drawn **COTTON BAGS,** 4″ × 2½″, 10/- per gross.

GEC electric **HOT-CUPBOARDS,** large and medium sizes, and other canteen equipment.

New and secondhand **CARTONS,** large quantities available. Also paper bags and paper.

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THE CRACK PULVERISING MILLS, LTD
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"DOHM LTD., PULVERISING" raw materials everywhere. We have 12 factories. 167, Victoria Street, London, S.W.1.

GRINDING of every description of chemical and other materials for the trade with improved mills. THOS. HILL-JONES, LTD., "Invicta" Mills, Bow Common Lane London, E. Telegrams: "Hilljones, Bochurch, London," Telephone: 3285 East.

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